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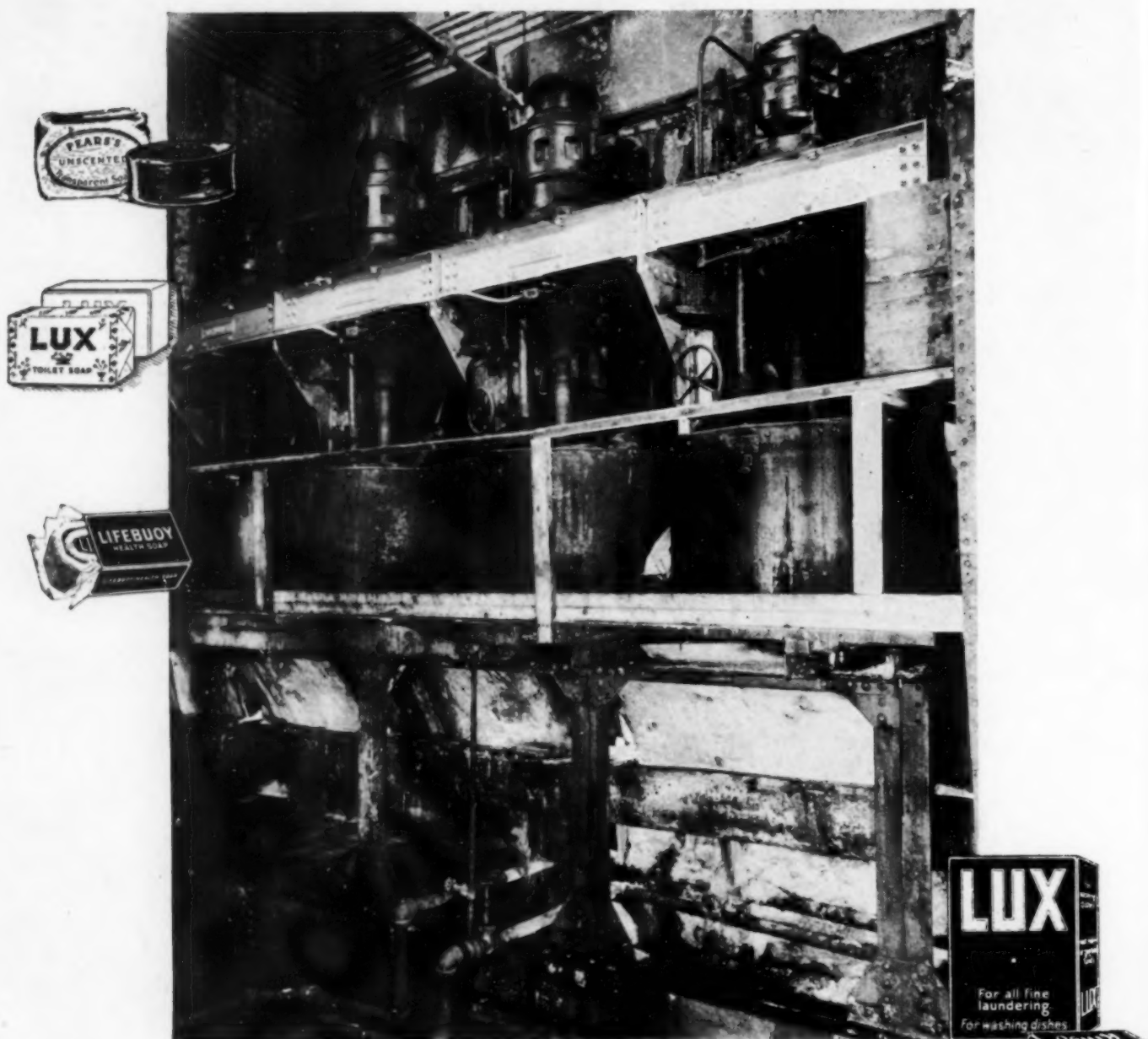
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Searchlight Section194
Professional Directory...200
Ready Reference202
Alphabetical Index210

CONTENTS

A Pacific Coast Setting for Industrial Research.....	460
PAUL D. V. MANNING describes the new research facilities of the Celite Products Company.	
Concentrated Nitric Acid by Direct Pressure Synthesis.....	474
GIACOMO FAUSER, Italian engineer, discusses a new and interesting process now in actual production at Novaro.	
High Pressure Gas Research at the University of Illinois.....	463
BY NORMAN W. KRASE, <i>Chemical Engineering Division, University of Illinois.</i>	
Nitration—A Unit Process of Chemical Engineering.....	466
BY P. H. GROGGINS, <i>U. S. Bureau of Chemistry and Soils.</i>	
Many New Fields Invaded by Spray Drying.....	470
BY EARL D. STEWART, <i>Douthitt Engineering Company.</i>	
New Data on Oxygen Concentration for Dust Prevention.....	479
BY P. W. EDWARDS and R. W. HARRISON, <i>U. S. Bureau of Chemistry and Soils.</i>	
Engineering Methods Economically Combat Stream Pollution.....	483
BY W. L. SULLIVAN, <i>Westinghouse Lamp Works.</i>	
Electrochemical Products Emphasize Interdependence of Processes and Industries.....	486
BY CHARLES L. MANTELL, <i>Consulting Engineer.</i>	
The Future of Chestnut Tanning Materials.....	468
BY CHARLES R. OBERFELL, <i>John H. Heald & Company.</i>	
Present Commercial Prospects for Low-Temperature Coking.....	468
BY R. S. MCBRIDE, <i>Assistant Editor.</i>	
Factors Affecting the World Nitrogen Situation.....	469
BY HARRY A. CURTIS, <i>Professor of Chemical Engineering, Yale University.</i>	
German Practice in Recovery of Wool Grease.....	473
BY ERNEST WOLFF, <i>Garwood, New Jersey.</i>	
Heat Conductivity as a Factor in Heat Transfer.....	481
BY ROBERT WORTHINGTON, <i>International Nickel Company.</i>	

Editorials	457	Equipment News	497	Personals	511
Readers' Views	489	M'frs' Publications.....	501	Market Prices	518
Book Reviews	490	Patents Issued	502	Industrial Develop-	
Plant Notebook	495	News of Industry.....	504	ments	520

Modernization

MORE than four hundred engineers, industrialists and equipment manufacturers have contributed to the symposium on Modernization that awaits the readers of the September *Chem. & Met.* As a worthy member of the series of special theme issues on Corrosion, Severe Service, Process Steam, etc., *Chem. & Met.*'s Modernization number promises a valuable fund of information that will help the chemical engineering industries in eliminating the obsolete in process and equipment. You will want to preserve your copy as a useful handbook of operating methods.


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Penalties of Leadership

AS AN INDUSTRY grows in size and influence there is a corresponding increase in its responsibility to the public. Chemical engineering industries are no exceptions; but because many of them are immature and comparatively undeveloped there has not always been a full appreciation of the extent and actual cost of this obligation. A manufacturer attains a position of leadership through the performance and quality of his product. He maintains this position through constant research and development. He keeps in advance of his competition by increasing the service he renders and at the same time preparing for the step next ahead in the ultimate development of his industry.

IN THE organization that first developed pyroxylin lacquer as an automobile finish, there are now available more than four thousand different formulas for producing various shades and gradations of color in the finished product. The actual monetary cost of the laboratory work alone in developing, selecting and blending the pigments and otherwise perfecting the operating formulas has averaged about \$40 for each color variation. Much of this money might have been saved by limiting the output to a few standard colors and maintaining mass production at a lower unit cost. But the company foresaw that if it was to maintain the leadership it had acquired through its original technical development, it must be in a position to create as well as to supply an immensely broadened market for its product.

OUTSIDE of the chemical industry, a more familiar example of industrial pioneering is to be seen in the development of commercial aviation, and more specifically in the coordination of air and rail transporta-

tion. Obviously the traveling public is not yet ready to meet the full cost of such an improved service, but if the railroad is to maintain a position of leadership in the transportation field, it must be willing to carry the financial burden of this development until it reaches a self-supporting and eventually profitable basis.

MANUFACTURERS of electrical equipment have consistently demonstrated the ultimate profit in a heavy investment in future development. In the telephone organization an engineering division gives its entire attention to planning a program fifty years in advance of present operations. Turning to other industries we find that the largest of the oil companies has invested in research in the production of motor fuel from coal and other materials that will probably be available when our petroleum resources have been exhausted. Henry Ford is reported to have spent a hundred million dollars within the past few years in order to maintain, or perhaps to regain, his position in the automotive field. His most recent investment in the development of a Brazilian rubber supply is also to be charged to the same account, namely, maintenance of industrial leadership.

OTHER examples may be adduced, almost without number, but these are perhaps sufficient to indicate something of the way in which important industries are meeting the obligation of leadership in their respective fields. Chemical engineering industries that are to remain in the vanguard of progress must be willing to pay the price of adequate research and to invest a fair proportion of their resources in industrial development far in advance of immediate requirements.

Welcome to British Chemical Engineers

MID-AUGUST will witness the arrival in America of the most impressive delegation of British chemical engineers and chemists that has ever come to our shores. Both in numbers and in professional repute the party will represent adequately the rank and file of British chemical industry.

Acting as host, the American Institute of Chemical Engineers has invited the Institution of Chemical Engineers to participate in a joint meeting and tour of industrial centers of Eastern Canada and United States. The Society of Chemical Industry will also be the guests of the American Institute for two weeks prior to the annual meeting of that organization in New York City. Two special trains will transport the combined party.

Chem. & Met. extends a hearty welcome to these British visitors. For several weeks they will have an opportunity to see American industry at first hand and mingle with American chemical engineers and chemists. The two weeks tour will give an unusual opportunity for fraternizing and for intimate exchange of thought and opinion on scientific and industrial subjects. No measure of value can be applied to the benefits that must inevitably result from this international event, of which we hope there will be many more in the future.

How Long Will We Have Domestic Chestnut Tannin?

ELSEWHERE in this issue is a brief interpretation of the present economic situation affecting the supply of chestnut tanning materials from domestic wood. It implies no immediate cause for alarm, but it makes clear that sooner or later the United States will face the serious question, Where shall we get our vegetable tannin supply?

Undoubtedly we can, if necessary, abandon vegetable tanning, even for sole leather, and go to mineral tannage; but that is undesirable because of the difference in the performance of the leather if tanned exclusively with chrome. As a second possibility, and one somewhat less objectionable, we can become entirely dependent on foreign chestnut. That, however, is not in keeping with the industrial policy of any major nation and not a plan at all satisfactory to contemplate. There is a third and seemingly satisfactory alternative. We can, while there is still ample time, undertake adequate research to determine just what it is in chestnut tannin that gives the preferred form of leather.

It is not beyond the range of probable successful research to determine the actual constituents of chestnut tanning compounds that are required. It would seem logical that such a job be undertaken on a reasonably comprehensive basis at an early date. If the start is made promptly there will be ample time to investigate the correctness of early conclusions by practical large-scale tanning experiments. Within the ten or fifteen years before there need be any serious shortage of domestic chestnut tanning compound we might be able to develop equivalent, or even superior, substitute synthetic tanning compounds.

As indicated by Mr. Oberfell such a development will probably ultimately come under the economic pressure

of shortage of domestic supply. It would seem better, however, not to await complacently that time of threatened shortage. It would seem logical instead to undertake the fundamental research that is required immediately. This is the sort of job on which the leather research agencies of the federal government can very well be employed. There is probably not yet sufficient economic pressure to warrant the study by any commercial leather manufacturers. But there is ample economic justification for the Government going into the studies on a preliminary basis so that when industry needs the fundamental information it will be already available for industrial application.

The Plant Store Room as a Hardware Shop

AMONG the multitude of little decisions which plant managers must make there is probably none more difficult than the proper determination of what to keep on hand in the plant store room. There are certain obvious requirements, spare parts and often-used supplies, which should be stocked. There are equally obvious items for which no one can justify store room space, because they are seldom required or are readily available at the nearby hardware store. The real problem lies in judging the large middle group, regarding which there is reasonable ground for difference of opinion.

One plant manager has recently offered an interesting basis for judgment of such items. He starts out with a determination of the maximum value of stock on hand which he is warranted in carrying. This grand total of inventory is, however, not fixed for all conditions, but is varied according to the extent of the business. When the plant is very busy a certain inventory total is indicated; during slack periods which give promise of continuing for some time a lower inventory value is deemed the appropriate maximum.

The second stage in determining purchasing policy under this plan is to list all of the possible items to be carried in stock in the order of their relative importance. This importance is judged on the basis of the urgency of probable need in the plant, frequency with which the item is required, relative availability in nearby stores or from nearby manufacturers, and relative cost if purchased wholesale or if purchased singly only when needed. With such a priority list extended to include the stock value for each item, it is very easy to determine at what point to draw the line between those materials and tools to be carried in stock and those which will be purchased only when required. This line will be drawn at whatever point in the priority list the cumulative total of the most urgent becomes equal to the estimated proper inventory value.

One plant in which this system has been applied is carrying an inventory of about \$200,000 in its stock room. There is for each item a minimum stock quantity and an indicated quantity to be ordered when this minimum is reached. Changes from the authorized stock list are made only with the approval of the works manager. Maintenance of the stock thus becomes automatic on an approved basis. The responsibility of the stock clerk is thus clearly defined and in case of delay resulting from missing parts or materials it is easy to determine whether the stock list was at fault and thus the responsibility

rests on the management, or whether the stock clerk has erred by allowing a departure from the authorized purchasing plan. Such definite placing of responsibility contributes much to care in stock maintenance and eliminates much of the opportunity for that type of carelessness which will result in unwarranted and unnecessary operating delays through lack of proper tools, parts, or supplies.

The same scheme is applicable in all varieties of works, not only in the store room where tools, repair parts, and miscellaneous supplies are carried, but also in the maintenance of stocks of raw material and the maintenance of stocks of standard finished products ready for prompt filling of customers' orders.

Chemical Safety Takes the Floor

WHEN the annual Congress of the National Safety Council convenes at its New York meeting on October 1, more than six thousand engineers and executives from all parts of the country will assemble to bear witness to the growing spirit of safety-consciousness which is prevailing American industry. Many speakers, eminent in their fields, will be present to discuss the factors that go to make up the safe chemical plant. Few in industry are so well posted in the avoidance of industrial hazards that they can afford to pass by information which not only serves a great humanitarian purpose, but which postulates better morale, better work and larger dividends.

There is, however, a plea in order before the meeting—a plea that chemical engineers will attend in full realization of the part that intelligent inspection, maintenance and handling of equipment must play in the building of a structure of safety. Unsafe equipment is disappearing; but some of it still exists. Safe plant becomes unsafe when improperly maintained. Everlasting inspection and repair are the price of chemical safety. The plant safety engineer must see that the price is paid. It is not enough that he be competent as a guide to conduct the factory inspectors through only such parts of the plant as it is expedient for the inspectors to see.

Many avoidable accidents are the direct result of lax inspection. A single instance comes to mind in which an operator, in pursuit of duty, lost his life when an ancient nitric acid line let go. It was in a chamber sulphuric acid plant and the walls were liberally plastered with safety posters. Strong nitric acid containing a small percentage of sulphuric to reduce corrosion and used to supply nitrogen oxides for the chambers was stored in iron tanks and handled in iron pipe lines. The operator, discovering a sudden leak in a line, attempted to close a valve—which went to pieces in his hands. There, in the shadow of a safety bulletin, an operator died for want of proper inspection and lack of any sort of protective device. The safety engineer had been too busy in devising means for getting the factory inspectors through the plant.

Risking an accusation of harping and preaching, we repeat that inspection and repair, repair and inspection, everlastingly carried out are the price that chemical industry must pay. There is no substitute. Counterfeit coin will reap worse than it gives.

Chemical Research in Great Britain

CENTRALIZED control of governmental research has been proposed a number of times as a solution for the problems in departmental jurisdiction that occasionally arise among our scientific agencies in Washington. Such a method has been in operation in Great Britain for the past eight years and some of the experience gained in its successful administration there might well be studied for possible application by our own government.

We are indebted to Sir James C. Irvine of the University of St. Andrews, whose recent lecture before the Institute of Chemistry in Evanston contains many thoughtful commentaries on the status of chemical research in Great Britain. His government, Sir James reports, has lately taken an entirely new attitude toward science and has become a generous patron in its support. Directly after the war a Department of Industrial and Scientific Research was established as an official branch of His Majesty's Treasury and now has direct authority for the appropriation of more than \$2,500,000 a year for research purposes.

It is particularly significant that this governmental department is made up wholly of scientific men. As each research project is proposed it must be passed upon by these men who are especially qualified to judge the probable scientific and industrial value of the work. And since the department holds the authority for the appropriation of funds, it can assign the project to the particular governmental or industrial agency best qualified to carry it through to completion.

Most of the major projects are assigned to two large government laboratories, one of which deals primarily with customs and excise while the other is a research organization comparable to our Bureau of Standards. Associated with the latter is the fuel research station where approximately a million dollars a year is now expended on the chemical and chemical engineering investigation of fuel production and utilization. But the interest to the British Government does not end with the governmental institutions for it is extended through substantial grants of funds to a number of industrial research associations. British industries, through their respective associations, submit their more fundamental problems to the department and the accepted projects are assigned and supported by public funds up to the extent of fifty per cent of their total cost. Governmental appropriations for this purpose total about \$400,000 a year.

Nor is the type of investigation which Sir James calls "pure, disinterested research" neglected. Last year \$170,000 was granted to young graduates to enable them to continue their studies at the universities. Work such as that of Professor Bone on high-pressure combustion and the researches of Sir William Bragg are being supported to the extent of \$35,000 a year. Many similar examples might be cited but these are sufficient to indicate the comprehensive views and policies of the governmental department.

Such an attitude toward research and its generous support by the British Government is indeed a creditable record in a country already severely handicapped by heavy taxation. It is a record that can be profitably studied if the research activities of our own government are to be coordinated and adequately supported for more effective results.



*Portion of Plant and Operations
in Cutting Bricks of Diato-
maceous Earth*

CHEMICAL industry of the present era in the United States has witnessed the overnight scrapping of plants the positions of which had been previously considered as almost impregnable. Progress in all lines of chemistry and related industries has been phenomenal; meanwhile the chemical engineer has often been called upon to produce, almost at once, new products to be used in other industries. Loss of markets for other products has come just as suddenly. In a realization of this situation, applied industrial research has been placed on guard against such losses and is even carrying the fight into the territory of the enemy—industrial stagnation. The new research laboratory which the Celite Products Company has built at White Hills, California, near Lompoc, is a fine example of the confidence of capital in the skill of the chemist and chemical engineer. This new laboratory will enable the company to enlarge considerably the research work in developing new fields for its product that has now been carried on for many years.

IN TERTIARY or Quaternary geological history, over 6,000 different species of a microscopic plant known as the diatom, living and dying in great profusion, built up with their skeletons great deposits of what we now call diatomaceous earth. At the present time there are known deposits of these minute skeletons in California, Virginia, Maryland, Colorado, Connecticut and New York. These are being worked and marketed by a number of operators in the United States, the most important deposits being located in California. A typical analysis of the California raw material on an

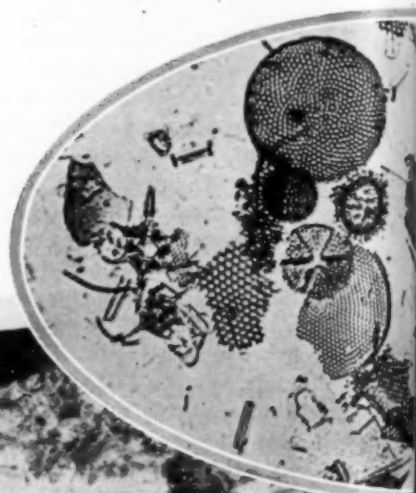
A Pacific Coast

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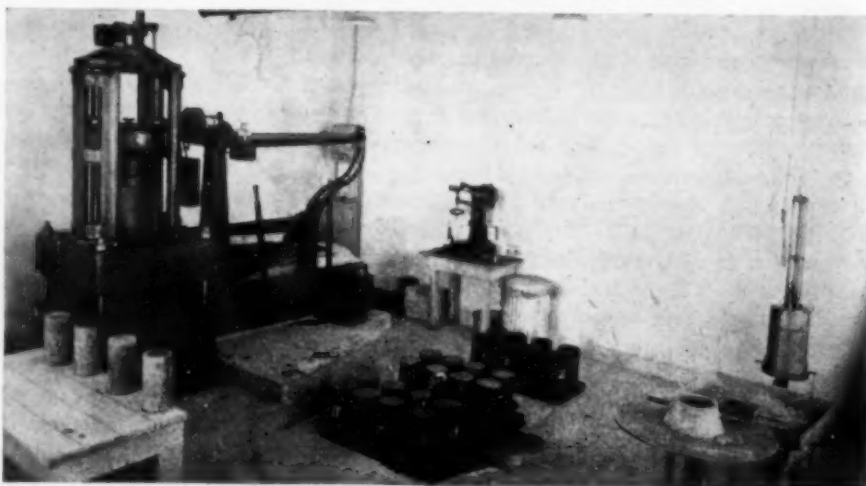
By Paul D. V. Manning

Assistant Editor, Chem. & Met.

Prevailing Diatom at Lompoc, Calif., Deposits Revealed by Photomicrograph.



Plant of Celite Products Company at Lompoc, Calif.

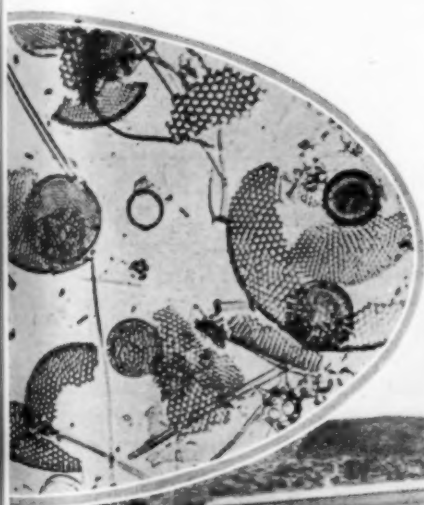


Cement Testing Room of Laboratory

Setting Industrial Research



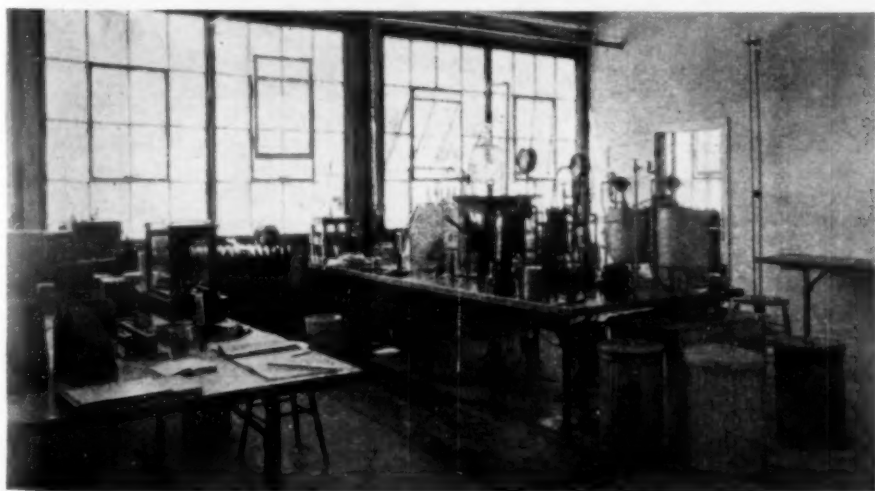
Removal of Insulating Brick
Gave This Mountain Its Steep
Profile Face



6,000 Species of These Or-
ganisms Have Left Verita-
ble Mountains of Skeletons.



New Laboratory on Site of Deposits at Lompoc



View Into New Filtration Laboratory

ignited basis shows it to contain:

SiO ₂	93.6 per cent
Al ₂ O ₃	3.7 " "
Fe ₂ O ₃	1.3 " "
CaO	0.7 " "
MgO	0.6 " "
Undetermined	0.1 " "

The supply of good raw material is much greater than the demand at present and for this reason the chief task of research is to develop new uses and new products. At the same time, in order to safeguard existing markets and uses, supervision must be exercised over production to secure uniformity of product and a chemical service must be maintained to co-operate with user and sales division.

AS A first step in this program, the largest producer of diatomaceous earth, the Celite Products Company, has recently completed and equipped a large laboratory costing over \$100,000. The laboratory is located at the production plant and is pictured in accompanying illustrations. This laboratory, with its staff of ten control and twenty research men, is directly responsible for the maintenance of production standards as well as development and research.

The Lompoc deposits, known as White Hills, cover a total of about 2,200 acres. The deposit itself is practically continuous and consists essentially of one or two predominating species of diatom skeletons, such as are shown in the photomicrograph. Several small mountains form the larger part and it is mainly from these that the raw material for the several finished products is drawn. The plant and a part of the operations also appear in the illustrations.

As first produced, diatomaceous earth was mainly used as a heat insulating material: for this purpose it

is excellent because of the many minute occluded air cells. Several types of insulating materials for different uses have been developed by the laboratory. Sil-O-Cel bricks are cut directly out of the native mineral after the laboratory has passed on the borings for location, in order to be certain of uniformity and other desirable characteristics of the diatomaceous earth. The bricks are sawed out by automatic machinery, being cut slightly larger than the standard brick size so that when processed and ready for use they are of proper size and shape. After being cut, the bricks are carried by tramway to the kilns for drying and processing. Subsequently they are packed in cartons and warehoused for shipment.

In addition to what might be termed the geological control for the selection of the location for cutting the bricks, the raw material is further controlled microscopically by a well-equipped laboratory for this work. At the same time research and testing on heat conductivity are carried out in a laboratory equipped for this work by apparatus similar to that of the Bureau of Standards.

The powdered material from other parts of the deposit is used partly for the production of the Sil-O-Cel powder and other heat insulating products, including cements and fabricated bricks.

Chemical engineers have long been familiar with the use of diatomaceous earths as filtering aids. Several varieties are now made at Lompoc and through research the time required in filtration has been materially lessened. In the three grades now manufactured, the increase in speed corresponds to a ratio of 1, 2 and 5. These grades are obtained by calcination and chemical treatment. The filtration laboratory runs control tests every two hours on these products and these tests involve special pressure filter tests. In addition, the organization maintains several portable units for service and is carrying on fundamental research on filtration and clarifying problems in a large number of connections at the plants of its customers.

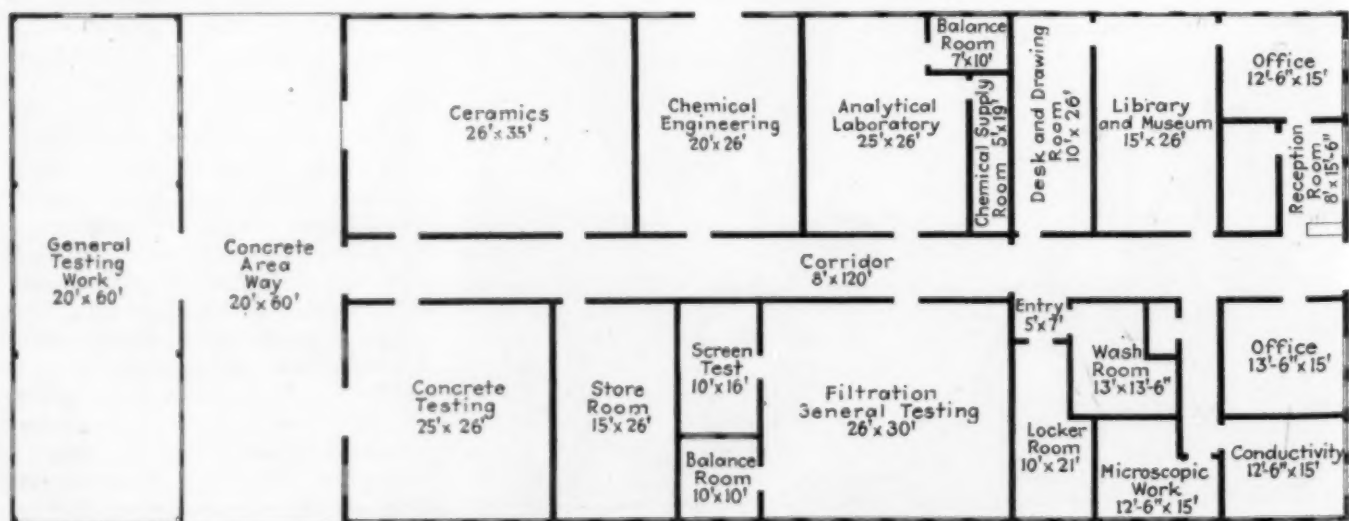
Another important use of diatomaceous earth is its use in concrete to increase the "workability," homogeneity and cohesiveness of the mix. The addition of a small amount to the concrete mix has been found to increase the workability and to prevent segregation. The degree of water tightness and the uniformity of the resulting concrete are greatly increased. Due to the total inadequacy or lack of standards for tests, the first task of the laboratory in this field has been to devise a set of standards and tests as well as new and accurate apparatus for this work. This has been done at Lompoc and at Washington in co-operation with the Bureau of Standards, where a fellowship has been maintained by the company for several years. At Lompoc, the cement testing laboratory has available much special equipment. The apparatus for testing the "workability" is especially noteworthy. Views of this and the filtration laboratory appear at the bottom of the foregoing pages.

The remainder of the laboratory includes rooms and equipment containing many types of mills, vacuum filters, air separator, a high pressure boiler, an extrusion press and calcining and drying kilns. There are in service also a complete ceramics laboratory and other rooms and equipment for analytical work and hydrogen ion determination, by electrometric and colorimetric methods. The research work on particle size is especially important since it is desirable to control carefully the amounts of various sizes of silica that enter into each product. Photomicrographic apparatus, a dark room and a library are also available. The laboratory, as is suggested by the appended floor plan, is singularly complete and well arranged, and indicates the considerable thought and foresight that entered into its design and construction. With ample room for expansion and exceedingly generous facilities, the enlarged research program should go far.

The author is greatly indebted to the Celite Products Company for the privilege of visiting its laboratory and viewing its operations.



Brick Cutting Machine in Operation on Face of Mountain



Floor Plan of Celite Products Company Laboratory

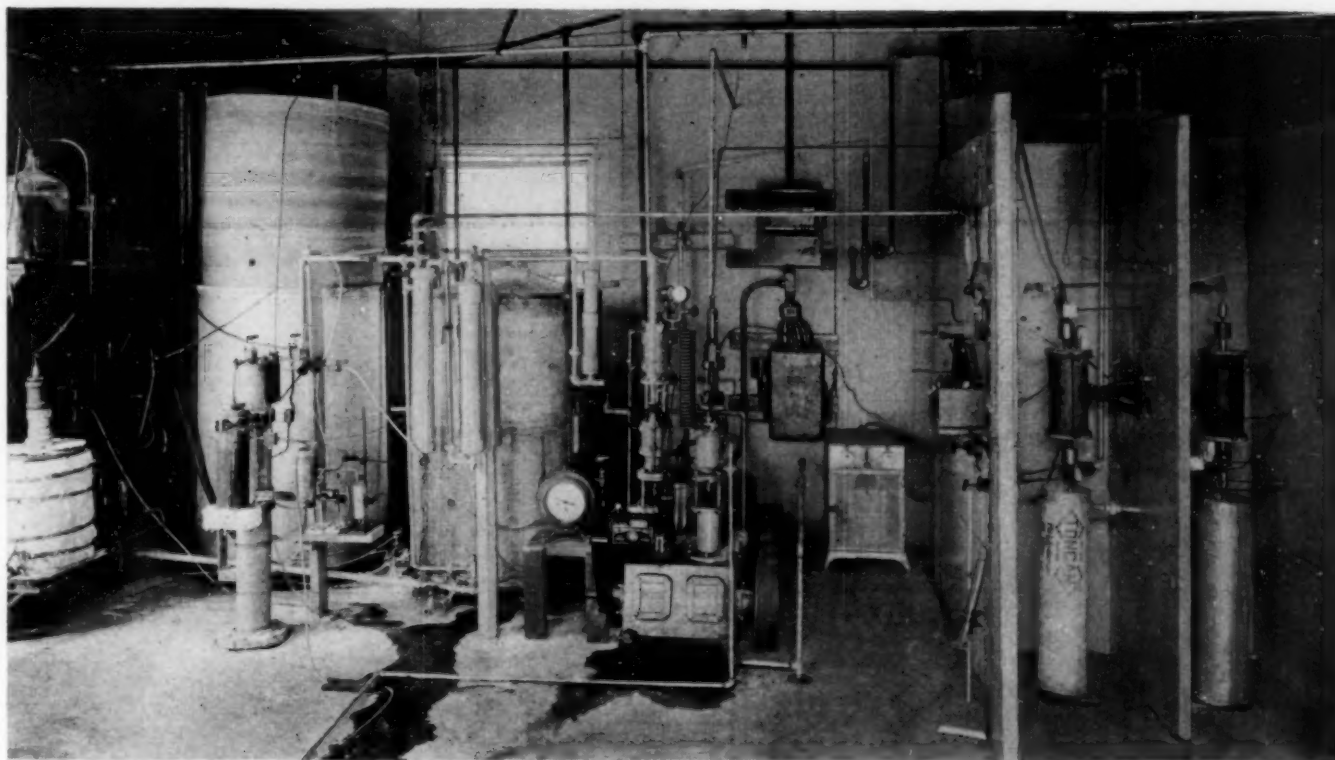


Fig. 1—General View of Apparatus for High Pressure Synthesis

High Pressure Gas Research at the University of Illinois

By *Norman W. Krase*

Chemical Engineering Division, University of Illinois, Urbana

THE PAST three or four years have witnessed a developing interest on the part of universities in the application of high pressure to many phases of chemical research. There are at present four university laboratories in which gas pressures up to 15,000 lb. per sq.in. are readily obtainable and other institutions show an awakening interest. For this reason it seems desirable to describe the installation of pressure equipment at the University of Illinois.

The laboratory building is of wooden construction and is 25 by 20 feet with a height at the eaves of 14 feet. In order to reduce the general hazard the laboratory was located at some distance from other buildings. While the probability of explosion or fire is not much greater than in other types of chemical research, this precaution is desirable. Furthermore, a comparatively light, wooden building lends itself admirably to the many modifications and rearrangements of apparatus that are inevitable in this kind of work.

In the range of pressures from atmospheric to about 4,000 lb. per sq.in. (275 atm.) many interesting problems arise and much work can profitably be done with relatively simple and inexpensive equipment. Fig. 1 is a general view of this equipment. At the extreme left is the carbon monoxide generator, which is essen-

tially a heated, lead-lined steel container holding about 10 lb. of sulphuric acid. On the shelf above is a carboy of formic acid which is slowly emptied into the generator. The evolved vapors are cooled and scrubbed with caustic and led to a 150-cu.ft. water-sealed holder outside of the building. From this storage the gas is brought in as needed to a 30-cu.ft. holder shown on the left. Here it may be mixed with any other gas or used directly for compression. Fig. 2 is a diagrammatic sketch which shows the arrangement of this equipment. The gas to be compressed is pumped out of holder *B* (Fig. 2) by means of the three-stage compressor, *F*. In its passage from the holder the gas goes through drying and purification towers shown in the drawing at *D*. The purification train should be of sufficient capacity to insure adequate scrubbing to remove both gaseous and suspended impurities. Three-stage, water-cooled compressors of small size are available from several manufacturers. When installed these should be provided with a safety valve tested to release at a safe pressure and with an oil scrubber to remove entrained oil carried out of the pump by the gas. The pump discharge is connected to the low-pressure storage cylinders, *G*. The cylinders should preferably be tested at about 7,500 lb. pressure and used at about 4,000 lb. For most catalytic

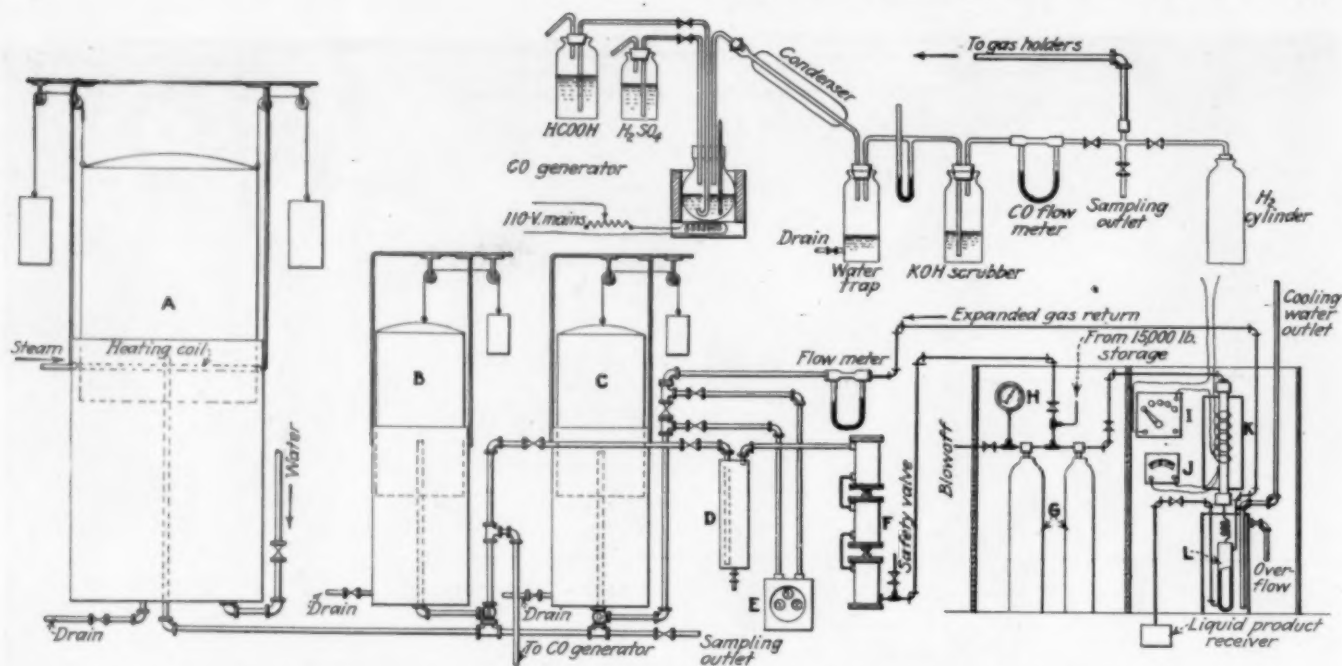


Fig. 2—Diagrammatic Arrangement of Apparatus for Synthesis at 4,000 lb. pressure

(A) 150 cu.ft. gas holder; (B) 30 cu.ft. gas holder; (C) Expanded gas holder; (D) Sodium hydroxide scrubbing tower; (E) Wet meter; (F) 3-stage compressor; (G) 4,000 lb. storage cylinders;

(H) High-pressure gage; (I) Temperature control rheostat for catalyst tube; (J) Potentiometer; (K) Electric furnace, catalyst tube; (L) Condensate trap.

work 2 cu.ft. of storage capacity is ample for one catalyst unit.

The storage cylinders, gage and valves are shielded from the main laboratory by a three-sided steel compartment open at the rear and top. By providing extension handles for valves, the operations may be conducted entirely from outside the steel room. For ordinary catalytic purposes, the gas is drawn from storage by opening a valve which is at the end of the catalyst system. This permits the gas to expand and enter the 30-cu.ft. holder, C. The design of the catalyst tube, etc., will depend to some extent on the nature of the experiments to be undertaken. For some reactions of mixed H_2 and CO a 1-in. O.D. by $\frac{3}{8}$ -in. I.D. Nichrome tube, which is internally copper plated, has proved satisfactory. About 15 c.c. of catalyst may be used which usually permits a convenient rate of gas flow. To insure a uniform temperature along the length of the tube, it is feasible to cast an aluminum sleeve around the Nichrome tube for about a foot of length. For temperatures up to 500 deg. C. a split, multiple-unit electric furnace K and rheostat I furnish adequate control. For small catalyst tubes of this kind it is difficult to measure the actual catalyst temperature with a thermocouple. By measurement of the temperature of the aluminum sleeve and the average difference between the inside and outside tube temperatures, the catalyst temperature may be approximated to about a degree.

THE GAS passes downward through the tube and catalyst, then through a cooling coil and trap or receiver. The condensed vapors collect in the receiver, L, and may be drawn off at intervals by opening the valve connected to the bottom of the trap. The liquid may be blown out carefully into a glass flask. The uncondensed gas passes continuously through the trap to the expansion valve, through a flow meter and to the "expanded gas" holder. Samples of gas may be conveniently taken from this holder and analyzed. The connections to the compressor are such that gas may be pumped from either or both small holders to storage.

This arrangement permits the re-circulation of the expanded gas and the addition of fresh make-up gas to maintain a constant pressure.

A view of the catalyst chambers and one side of the steel room appears in Fig. 3. The potentiometer for measuring the temperature of the two catalyst tubes is shown together with the rheostat for furnace control. The two valves for gas expansion and liquid withdrawal, and the valve handle extensions through the steel plate are all on the same side of the chamber.

FOR PRESSURES above 275 atm. it is not feasible to use a compressor for small scale work. It is hoped that the near future will see the development of a compressor of low capacity with a pressure range of 200 to 1,000 atm. The simplest, as well as the least expensive method of obtaining gas at these pressures, is water pumping and gas compression over water. This scheme permits the use of hydraulic pumps of practically standard design. The operation is intermittent when done on a small scale but can be made practically continuous if desired. Fig. 4 shows the two high-pressure storage and compression cylinders. The operation is as follows: gas at about 275 atm. is led into the two cylinders. By means of the hydraulic pump water is forced into the bottom of the smaller (compression) cylinder until it is full, compressing the gas into the larger cylinder. The valve between the two is then closed. The water in the compression cylinder is forced out by more gas at 275 atm. and this gas, in turn is compressed into the larger cylinder by means of the hydraulic pump. Sufficient repetition of this process will result in the accumulation of gas in the larger cylinder at any desired pressure up to 1,000 atm. If the catalyst units have been designed for these pressures, the gas may be drawn off from this high-pressure storage in the same manner as previously described. It is important that the operation of the valves be from the outside of the steel room just as in the case above.

There are numerous details and features of design that affect the operation of high-pressure equipment but

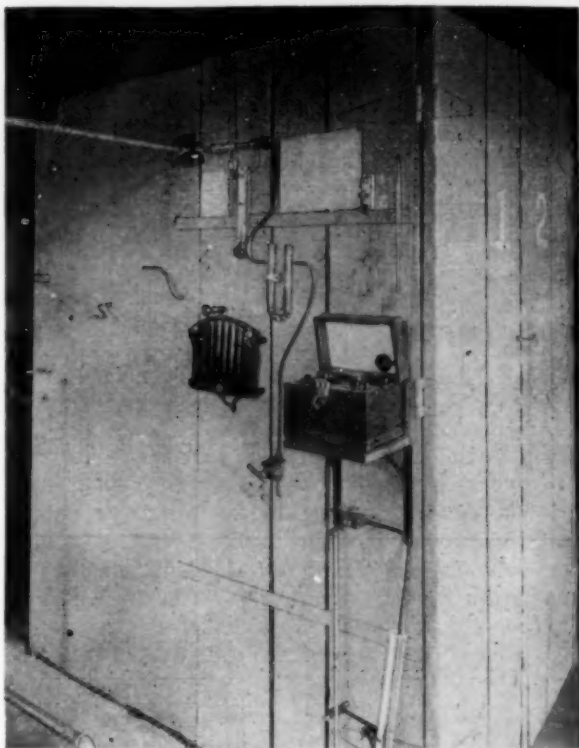


Fig. 3—Control Instruments and Valves Outside the Catalyst Chamber

in a short description such as this they cannot be dealt with, even superficially.

Mechanical Accessories—From the description it can readily be seen that high-pressure research equipment is a mechanical matter. No mention has been made of the fittings, connectors, valves, special forms of machinings and so on, that are required, but it is evident that high-class machine-shop facilities are indispensable. Without these the enterprise is doomed to failure.

The Fixed Nitrogen Research Laboratory of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has in compilation a bulletin descriptive of satisfactory equipment. This, when published, will include dimensional drawings of practically all special machine work that is necessary for a high-pressure laboratory. It should be invaluable not only in standardizing equipment but in helping newcomers in the field.

Chemical Accessories—In the general field of the formation of liquids from gases by the application of high pressure and high temperature, there are an infinite number of untried and thermodynamically possible reactions. If we consider only H_2 and CO it is evident that the liquid products alone will be varied and difficult of exact analysis. The mixture of aliphatic hydrocarbons, alcohols, acids and aldehydes that may result is an extremely difficult one to separate and analyze. It is obvious that a completely equipped organic laboratory and the services of experienced organic chemists are essential if intelligent progress is to be realized.

The problems, of course, are not limited to organic reactions, although these constitute at present the most fertile and most actively investigated field of high-pressure research. Many purely physical chemical problems present themselves for solution. The properties of compressed gases, such as compressibility, viscosity, specific heat and thermal conductivity, are in most cases unknown. Some progress has been made, notably by Bartlett at the Fixed Nitrogen Research Laboratory, in the measurement of

physical properties, but the field is still practically virgin. These investigations should permit the exercise of the highest type of physical chemical abilities.

Types of Problems—It has been pointed out that reactions involving the formation of aliphatic organic compounds form the most actively investigated field of high-pressure research. The attraction that this field has is probably due primarily to the fact that there is such an extremely large number of possible reactions and products. This fact also, by the same reasoning, makes it almost certain that, starting with a given gas mixture, more than one product will result. This is not such a desirable happening. The most valuable discovery would be one that would yield an almost pure, single product. The usual procedure is to select a catalytic body that yields some of the desired product and then to vary its composition, condition and so on, with the hope of improving the yield and purity of the desired product.

It is a purpose of this paper to contend that such "catalyst testing" is not the best aim of a university high-pressure laboratory. While a certain amount of this is inevitable, it appears practically impossible to "develop" a satisfactory catalyst under conditions existing in such a laboratory. Catalyst testing is largely an empirical matter requiring continuous operation of a large number of catalyst units and the services of a large number of men. It would seem that the time and facilities of university laboratories could be most profitably employed in the investigation of new and novel reactions that may at first glance seem to have no commercial significance, and in the collection of data of fundamental scientific importance. The perfecting of a process is best done by the industrial laboratory with its multiplied facilities; the small university laboratory is best fitted for pioneering.

The author takes pleasure in acknowledging the invaluable assistance of Messrs. B. H. Mackey, A. D. Singh, and H. Berg in the construction of this high-pressure laboratory.

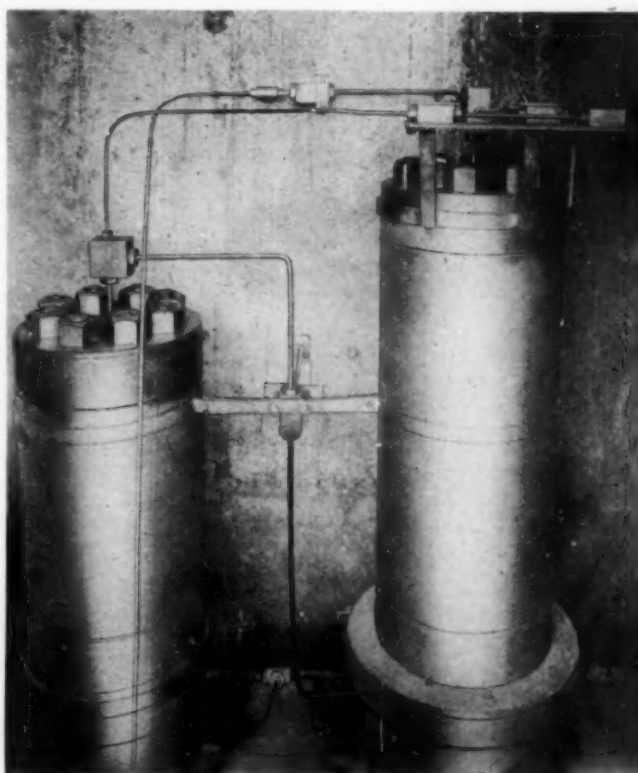


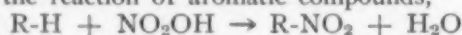
Fig. 4—Cylinders for Hydraulic Gas Compression to 15,000 lb.

Nitration—a Unit Process of Chemical Engineering

By P. H. Groggins

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Washington, D. C.

NITRATION may be considered as a process by which one or more hydrogen atoms from the ring of an aromatic compound are replaced by (NO_2) or nitro groups. From the following equation, which typifies the reaction of aromatic compounds,



it can be seen that the nitration process yields a nitro derivative and water. If nitric acid alone were used to carry on the reaction, the presence of progressively increasing amounts of water would so dilute it as to make it ineffective, unless an excessive amount had been used to start with. Under such circumstances the production of poly-nitro derivatives may be formed by the substitution of nitro groups for two, three, or more hydrogen atoms. The most expedient method for avoiding the diluting effect of the water is to remove it as fast as it formed. This is conveniently done by using as nitrating acid a mixture of nitric and sulphuric acid. The sulphuric acid present in the "mixed acid" will bind the water formed during the reaction and the nitration can, therefore, generally be carried out with approximately the theoretical amount of nitric acid. Since nitric acid is much more expensive than sulphuric acid a considerable saving is effected. The sulphuric acid, moreover, is recovered from the spent acid with only slight losses. In addition to serving as an economical dehydrating agent the presence of sulphuric acid makes it easier to keep the reaction under control and the milder conditions that are thus provided are instrumental in inhibiting the formation of oxidation products. The greatest advantage, however, relates to the commercial use of "mixed acid" for, unlike nitric acid, it corrodes the storage equipment and nitrating apparatus only to a very slight and unimportant extent.

THE nitrating acid may be replaced by its salts, such as sodium nitrate which, when mixed with H_2SO_4 forms nitric acid and sodium bisulphate. A number of patents have been taken out utilizing this economical procedure, particularly for the preparation of nitro-chloro-benzene. This method of nitration is unquestionably of great value in plants not possessing facilities for the denitration and concentration of spent acids. Generally speaking, however, the substitution of nitrates introduces mechanical difficulties, as well as problems in obtaining a pure product, and consequently has been adopted only to a limited extent.

Special investigation should determine the nitrating acid best suited for the preparation of each particular nitro-compound. It is apparent for example that mono-nitrations may be carried out with more dilute acids and

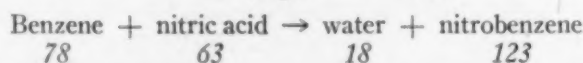
under milder conditions of temperature than are required for poly-nitro compounds. Moreover, the nitration of the former may be effected with only a slight excess (one to two per cent) of nitric in the mixed acid, whereas in the preparation of the higher nitrated compounds the nitric acid content of the spent acid is usually in excess of ten per cent.

IN considering the composition of mixed acids it is necessary to arrive at an understanding regarding the relationship of the three constituents HNO_3 , H_2SO_4 , and H_2O . For example, if the total acidity or water content of a mixed acid is kept constant and H_2SO_4 is replaced by HNO_3 , it would appear possible under such circumstances to maintain a definite excess of HNO_3 to hydrocarbon, and to nitrate progressively increasing quantities of material. Accompanying the replacement of H_2SO_4 by HNO_3 under such conditions there will be a proportionate increase in the water of reaction, and a corresponding decrease in the ratio of H_2SO_4 to H_2O at the close of nitration. Since excessive dilution of the nitric acid at the end of a run is conducive to incomplete nitration and loss of volatile hydrocarbon, such a practice is known to be productive of low yields of nitro-body. If, on the other hand, HNO_3 is similarly replaced by H_2SO_4 , still maintaining the same total acidity and nitric ratio to hydrocarbon, it is obvious that the productive capacity of the nitrator will be diminished and a larger amount of spent acid will be produced.

It appears advisable, therefore, to formulate the composition of the mixed acid so that a definite optimum relationship exists at the close of nitration between the sulphuric acid and water. This relationship is usually termed the D.V.S., i.e., the dehydrating value of sulphuric acid. It is expressed numerically by the quotient obtained from dividing the actual sulphuric acid content of the mixed acid by the total-water present when nitration is completed. The latter figure includes in addition to the water of reaction the water that is introduced with the mixed acid and hydrocarbon.

If, for example, a mixed acid of the following composition is used for the nitration of benzene, the dehydrating value of sulphuric acid may be calculated as follows:

$$\text{Composition of mixed acid} \begin{cases} \text{H}_2\text{SO}_4 = 60.0 \text{ per cent} \\ \text{HNO}_3 = 32.0 \text{ " " } \\ \text{H}_2\text{O} = 8.0 \text{ " " } \end{cases}$$



When molecular proportions of acid and hydrocarbon

are used, the water formed per 100 lb. of mixed acid (32 per cent HNO_3) will be:

$$\frac{63}{18} : \frac{32}{x}, x = 9.14 = \text{water of nitration}$$

To this must be added the water that already exists in the mixed acid, whence

$$\text{D.V.S.} = \frac{\text{actual H}_2\text{SO}_4 = 60}{9.14 + 8} = 3.51.$$

The calculations in terms of hydrocarbon are

$$\frac{78}{63} = 1.238 = \text{factor hydrocarbon to HNO}_3;$$

$$1.238 \times 32 = 39.62 = \text{per cent hydrocarbon}$$

to be used per 100 lb. of mixed acid containing
32 per cent HNO_3 .

$$\frac{78}{18} : \frac{100}{x}, x = 23.08 = \text{water of nitration per } 100$$

lb. hydrocarbon;

$$23.08 \times 0.3962 = 9.14 \text{ lb. of water of nitration.}$$

In actual practice the relationship between hydrocarbon and nitric acid is worked out in advance, and allowance is made for the presence of an excess over theory of HNO_3 during nitration. The calculations may be made with reference either to the hydrocarbon or the nitric acid, thus:

When 95 per cent of the theoretical hydrocarbon is used the hydrocarbon factor is

$$\frac{78}{63} = 1.24 \times 95 = 117.8 \text{ per cent}$$

$$1.178 \times \text{per cent HNO}_3 \text{ in M.A. (32 per cent)} \\ = 37.7 = \text{per cent hydrocarbon}$$

$$0.377 \times \text{water factor } 23.1 = 8.71 = \text{per cent water of nitration.}$$

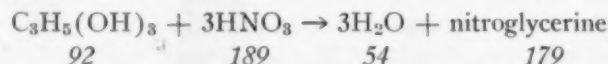
The same results are obtained by making the calculations with reference to a nitric acid ratio; thus, if instead of a 95 per cent hydrocarbon ratio, a 105 per cent nitric acid ratio is used, then

$$\text{ratio HNO}_3 \text{ to hydrocarbon } \frac{63}{78} = 0.808 \times 1.05 = 0.848.$$

$$\frac{\text{per cent HNO}_3 \text{ in mixed acid} = 32}{\text{per cent HNO}_3 \text{ ratio to hydrocarbon} = 0.848} = 37.7,$$

$$\text{D.V.S.} = \frac{\text{actual H}_2\text{SO}_4 \text{ in M.A.} = 60}{\text{H}_2\text{O of nitration} + \text{in M.A.} = 8.71 + 8.0} = 3.65.$$

When glycerine is nitrated the calculation procedure is similar.



Since dynamite glycerine ordinarily contains two per cent H_2O , this amount must be added to the water content. Furthermore only 98 per cent of the water of reaction will be formed: $0.98 \times 54 = 52.92$ lb. H_2O per 92 lb., or 57.5 lb. H_2O per 100 lb. of glycerine that is nitrated. The total water formed during the nitration of 100 lb. of glycerine is 59.5 lb., which when multiplied by the per cent of glycerine gives the water of reaction. As in the case of nitrobenzene this figure (per cent hydrocarbon) is obtained on the basis of a predetermined

ratio of hydrocarbon to HNO_3 . In this instance instead of using $\frac{189}{92}$ or 2.04 as the relationship, a factor of 2.30 is used in order to insure complete nitration.

<i>Mixed Acid for N. G.</i>	{	H ₂ SO ₄	60	per cent
		HNO ₃	38	" "
		H ₂ O	2	" "

The per cent glycerine would therefore be $\frac{38}{2.30}$

= 16.51. Then $59.5 \times 0.1651 = 9.82 =$ water of nitration;

$$\text{D.V.S.} = \frac{60 = \text{actual H}_2\text{SO}_4 \text{ in M.A.}}{9.82 + 2} = 5.55$$

The control of the D.V.S. is a matter of great practical importance in maintaining high efficiencies in nitrating operations. It has been found in the nitration of benzene, for example, that, when acids of the following compositions were used, *A* would often show the presence of unnitrated benzene and would generally give lower yields despite the fact that the total acidities were the same.

<i>A.</i> D.V.S. 2.96		<i>B.</i> D.V.S. 3.51	
54.0 per cent	H ₂ SO ₄	60.0 per cent	
38.0 " "	HNO ₃	32.0 " "	
8.0 " "	H ₂ O	8.0 " "	

For the preparation of dinitrobenzene a stronger nitrating acid is required and in addition it is necessary to use a larger excess of nitric acid. A mixed acid of the following composition is suitable for this operation:

<i>Composition of mixed acid</i>	{	H ₂ SO ₄	80.0 per cent
		HNO ₃	18.0 " "
		H ₂ O	2.0 " "
		HNO ₃ Ratio	1.1
		D.V.S.	7.0

The ease in which the nitro group enters the ring is reflected in the composition of the nitrating acid that may satisfactorily be used. Thus, the mixed acids suitable for the nitration of chloro-benzene, toluene, and naphthalene are much weaker than that required in the preparation of nitrobenzene:

<i>For the nitration of chlorobenzene</i>	{	H ₂ SO ₄	71.0	per cent
		HNO ₃	18.0	" "
		H ₂ O	11.0	" "
		HNO ₃ Ratio	1.01	
		D.V.S.	4.44	

<i>For the mono-nitration of toluene</i>	{	H ₂ SO ₄	58.7	per cent
		HNO ₃	23.8	" "
		H ₂ O	17.5	" "
		HNO ₃ Ratio	1.01	
		D.V.S.	2.42	

<i>For the mono-nitration of naphthalene</i>	H ₂ SO ₄	59.55 per cent
	HNO ₃	15.85 " "
	H ₂ O	24.60 " "
	HNO ₃ Ratio	1.01
	D.V.S.	2.04

Oftentimes cycle acid, i.e., spent acid from a previous nitration, is used in addition to the nitrating acids recorded above. The advantages attending the use of such diluted acids are numerous, particularly when the nitration is carried out with nitrates and sulphuric acid.

The Future of Chestnut Tanning Materials

By Charles R. Oberfell

John H. Heald & Company, Lynchburg, Va.

THE LEATHER INDUSTRY and the makers of tanning materials should be well informed as to the chestnut blight situation and the probable influence this may have upon the world's vegetable tannin supply. Exact forecasts would require a complete review of the world situation; but this is not as yet required in view of the very definite and determinable trends affecting the next 10 to 20 years.

The chestnut tree is doomed, which is a national calamity; but we do not think it will affect the supply of extract for from 20 to 30 years. The disease does not damage the wood—it simply girdles the trunk between the bark and the wood, thus throttling the tree. As long as the wood is sound it is suitable for extract. However, sound wood which has been dead for a long period presents a different and difficult problem in extraction and we find it necessary to alter our processes when using "blight" wood at our plants.

Chestnut wood does not decay rapidly, so aside from the high fire hazard in dead timber, it is believed by many in the extract industry that most of the trees now dead will stand and be available for extract for from 15 to 20 years. Although the blight is now progressing there are still large stands of timber not affected, from which one will see that there will be chestnut extract for many years to come. Some plants will of course lose their supply. Lynchburg and the Blue Ridge section will, we feel, be one of the first; but in other territories, for example, the Allegheny Mountain section, there are still plenty of trees not infected.

The whole proposition has been thoroughly surveyed in connection with the recent developments in the manufacture of chestnut board from the extracted chips. It requires approximately one million dollars for a 60-ton board mill unit. The interests involved are going ahead, however, feeling they have at least twenty years to operate.

Naturally the situation is serious from a long range viewpoint. The War Department is much interested and has been of considerable help in obtaining appropriations for the needed investigations. At the present time there is too much chestnut extract, resulting in a demoralized market situation, so that today and for five years past, the chestnut tree has been rapidly used up with no one making a reasonable, livable profit therefrom; in fact losses have been the rule.

Combination sole-leather tannages, that is chrome and vegetable liquors in which the amount of vegetable tannin required is much less than in full vegetable tannage, give more promise than straight chrome of helping out the situation. It might be said that the disadvantages of chrome sole leather are partially offset by this combination process. However, the United States might as well be dependent on imported extract as upon imported chrome salts during a national emergency; and during peace times vegetable extracts will always be obtainable, although not as cheaply as our domestic chestnut.

There is another possibility which may eventually provide the final solution, that is, synthetic tanning materials. We have had them for 14 years, most of them

bad and only a few partially successful, but the possibility exists. The problem has not received the intensive research which spells success. These materials do not "fill," or pack in between the fibers, giving firmness, wear and water-resisting qualities to sole leathers, but it is probable that a suitable synthetic tanning material will be developed for the preliminary or pre-tannage, and that the "filling" process can be accomplished by the use of so-called "spruce extracts" made from the refined waste liquors from pulp mills. Sufficient study along this line has been done to demonstrate that when economic pressure comes this will be the nature of the final solution.

Present Commercial Prospects for Low-Temperature Coking

By R. S. McBride

Assistant Editor, Chem. & Met.

RECENT British articles on low-temperature carbonization of coal emphasize to the careful reader the tremendous economic differences which confront the chemical engineers of Great Britain and those with which we are wrestling in the United States. The different price relationships and the different degree of availability of the various types of energy supply are so striking as often to reverse the significance of conclusions, sound for one country, but fundamentally unsound in the other.

One British list of low-temperature carbonization processes has been noted with particular interest, especially since fully one-third of these are credited to the United States. Of the 25 or more having United States interest or origin there is undoubtedly not a single one which can properly be called commercial in status at the present time. If one were to read the technical literature regarding these processes, not only that issued by their backers, but also that in the responsible technical magazines, he might get another impression than this. But one can assert very positively, without fear of successful contradiction by anyone, that there appears to be no immediate prospect of real commercial operation of any low-temperature scheme for the processing of coal or shale which has yet appeared on the horizon in the United States, with one possible exception. The only exception to the writer's knowledge is the KSG process, for which a plant is to be erected shortly in New Jersey.

In view of the considerable success which this KSG process has had in Germany, I am willing to believe that it may attain actual commercial status within a few years. However, it is very doubtful in my mind whether success in one or two localities peculiarly favorable for such operation should be taken to imply any large opportunity in the United States for low-temperature processing of coal in the immediate future. As a chemical engineer who would be delighted to see coal products further developed in every possible way, I hate to be forced to such a conclusion. But even though it may seem quite pessimistic, I think we should frankly face the fact that the appropriate economic niche in our fuel and energy system has not yet been found for low-temperature carbonization.

The main reasons for this conclusion are briefly as follows:

(a) The rich gas which would be produced can command little more than \$1 per million heat units as an enricher of uncarburetted water gas, and in many circumstances it would not command such a price. The gas has almost no other American market of consequence, except that of city-gas enricher.

(b) The ammonium sulphate made is, of course, negligibly small in quantity, making its recovery from a low-temperature process hardly worth while although unfortunately absolutely necessary if the gas is to find its most profitable applications.

(c) The low-temperature tars and oils are of questionable usefulness in the eyes of American industry. If produced on a large scale they must, for the present, satisfy themselves with a market at a price based upon their fuel value in competition with the fuel-oil fraction from petroleum. This means that the tars and tar oils will sell at most for five or six cents per gallon if produced on a large scale; to command a higher price they would have to find chemical markets, which will come eventually, but cannot be developed rapidly under present American conditions.

(d) To the extent to which light oil can be recovered from low-temperature processing it will command a market of an unlimited size, but a very definitely limited price. This price is that fixed by the current market for motor benzol, which during recent years has been, f.o.b. coke works, from 15 to 18 cents per gallon.

(e) The solid product from low-temperature processing of coal finds no American market as such. It must be pulverized for boiler firing to compete with pulverized coal, which is worth not more than \$2.50 per ton plus freight from the mine. Or the semi-coke may be briquetted and then compete with anthracite or bituminous coal or high-temperature coke for the household market, in which market it will command low prices at all points where bituminous coal is cheap, generally not more than \$2 per ton above the prevailing price for sized bituminous coal suitable for house heating, but \$1 to \$2 less than the price for anthracite locally prevailing. Under these circumstances the solid product of low-temperature processing will not in itself offer attractive financial inducement to the process promoters.

THERE is undoubtedly some niche in our fuel-energy system into which low-temperature coking will ultimately fit. This niche is in general undiscovered or undetectable at the moment. When discovered for one locality it is not necessarily known for another. And the enlargement of the niche to afford enlarged possibilities for low-temperature processing will be a slow and financially painful procedure at best. Our only important hope for striking new development of low-temperature processes in the United States will depend upon one of three things.

(1) Some new process far outstripping any yet demonstrated in through-put per dollar of investment cost and per man-hour of labor required.

(2) Some advancement in the scheme for making low-temperature semi-coke into useful household fuel, marketable with a profit in competition or nearly in competition with sized low-volatile bituminous coal.

(3) An enlarged demand, which presumably will come only slowly, for the liquid products of such low-temperature processing which cannot be met either by high-temperature tars and oils or by synthetic methods using other hydrocarbon raw materials.

Factors Affecting the World Nitrogen Situation

By Harry A. Curtis

Professor of Chemical Engineering, Yale University

SOMEONE has remarked that the sculptor's art is simplicity itself—he merely cuts off the stone he doesn't want. The statement is correct but leaves much to be said. In the same sense any outline of the world nitrogen situation must be inadequate, since it is an attempt to make appear simple that which is inherently complex. Of the factors which must be taken into account, the following may be mentioned as of importance:

1. Because of the role which nitrogen plays in national preparedness, many nations have undertaken to subsidize their air-nitrogen industries. A subsidy is, of course, a deliberate subversion of the economic laws of supply and demand, and therefore upsets all arguments based on these laws. In Europe, the extent of this governmental subsidy varies all the way from that of air-nitrogen plants which have been built and are being operated by governmental agencies, almost without regard to the economic considerations which control and limit private enterprise, to those milder forms of subsidy in which the government makes tax concessions or underwrites bond issues.

2. In spite of the very large output of synthetic nitrogen products, the export of Chilean nitrate last year was unusually large. The new Guggenheim plant has presumably shown that considerable economies can be accomplished in the production of nitrate, but it is not known just how cheaply the natural nitrate can be recovered when modern chemical engineering thoroughly penetrates the industry. Further, it must not be forgotten that the cost of production of Chilean nitrate under the old regime was a relatively small part of the price of nitrate at the port of New York, and it is quite evident that better technology in the industry cannot alone bring about a great reduction in the New York price.

3. Wherever reasonably pure hydrogen or readily purified hydrogen is available as a byproduct in considerable quantities, ammonia can be produced so cheaply that the situation is practically the same as in byproduct coke plants, i.e. the ammonia so produced will sell at whatever the market level may be and cannot be shut out of the market by competition.

4. The relation of cheap power to nitrogen fixation has been confused in much of the discussion which has centered around congressional hearings on Muscle Shoals. The development of the arc process in Norway where hydroelectric power was very cheap gave rise to the popular idea that cheap electric power and nitrogen fixation were necessarily linked. It has taken a long time to dispel this idea, but now there is evidence that many people think cheap power has nothing to do with nitrogen fixation. Such an idea is as erroneous as the original one. Indeed the very process which was supposed to free nitrogen fixation from dependence on cheap power is now being used in Norway, where synthetic ammonia is being produced very cheaply by means of the cheap hydroelectric power.

5. Under European conditions, at least in France, Belgium and Germany, it has evidently been found profitable to use coke-oven gas as a source of hydrogen for ammonia synthesis. Such studies as have been published dealing with this problem in the United States have concluded that the conditions here are not favorable to such a scheme. The situation should probably be re-examined now in the light of European experience.

6. Competition in marketing nitrogen products is likely to be exceedingly keen in the near future. On the other hand, the potential market is enormous and we have probably underestimated the changes in agricultural methods and conditions which will be brought about by use of fertilizers.

Extracts from an address before the American Chemical Society Institute of Chemistry at Evanston, Illinois, July 25, 1928.

Many New Fields Invaded by Spray Drying

By Earl D. Stewart

Douthitt Engineering Company, Chicago

THE REDUCTION of fluids, containing solids in suspension or solution, to a dry form is a problem frequently met in the chemical industry. This can often be carried out easily and simply by such methods as drying on trays or on hot rolls, though these methods sometimes leave much to be desired in capacity and heat economy. Also some materials are so readily affected by local overheating that these methods are impracticable, if not impossible. Materials of low melting point or low coagulation temperature, for example, are difficult to dry on rolls or trays. Drying may be accomplished without melting or coagulation, it is true, but the hourly capacity is so low that the method is not attractive.

The use of spray drying methods will frequently offer a way out of the difficulty and at the same time show substantial economies in fuel, power and labor. The manufacture of powdered milk and milk products (such as skim milk, buttermilk, whey and malted milk) by spray methods is firmly established and the bulk of all powdered milk products is made in this way. A typical plant for the manufacture of milk powder is described in *Chem. & Met.*, Vol. 33, pp. 157-159, March, 1926.

Spray drying offers a number of attractive features for many drying processes. There is possible a wide variation and close control of temperature conditions

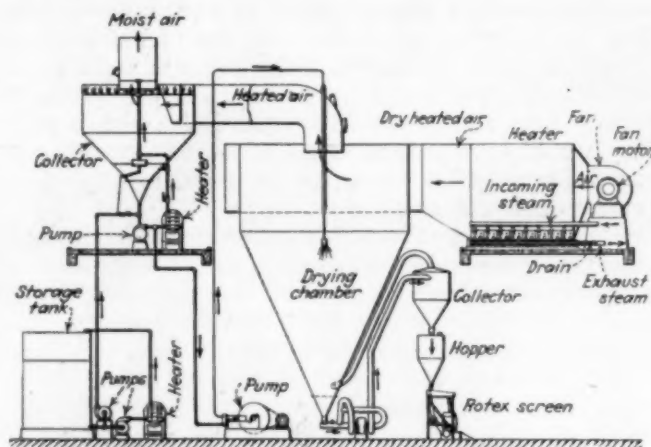


Fig. 2—Sectional View of the Spray Process Plant

high solubility and a consequent high boiling point, drying may cease at a considerable concentration, with the formation of drops of the liquid in the solid discharge hopper. Highly soluble sugars may exhibit this difficulty but it is fortunate that the presence of colloidal material seems to inhibit the effect—and it is with such mixtures containing colloids that industrial practice usually deals.

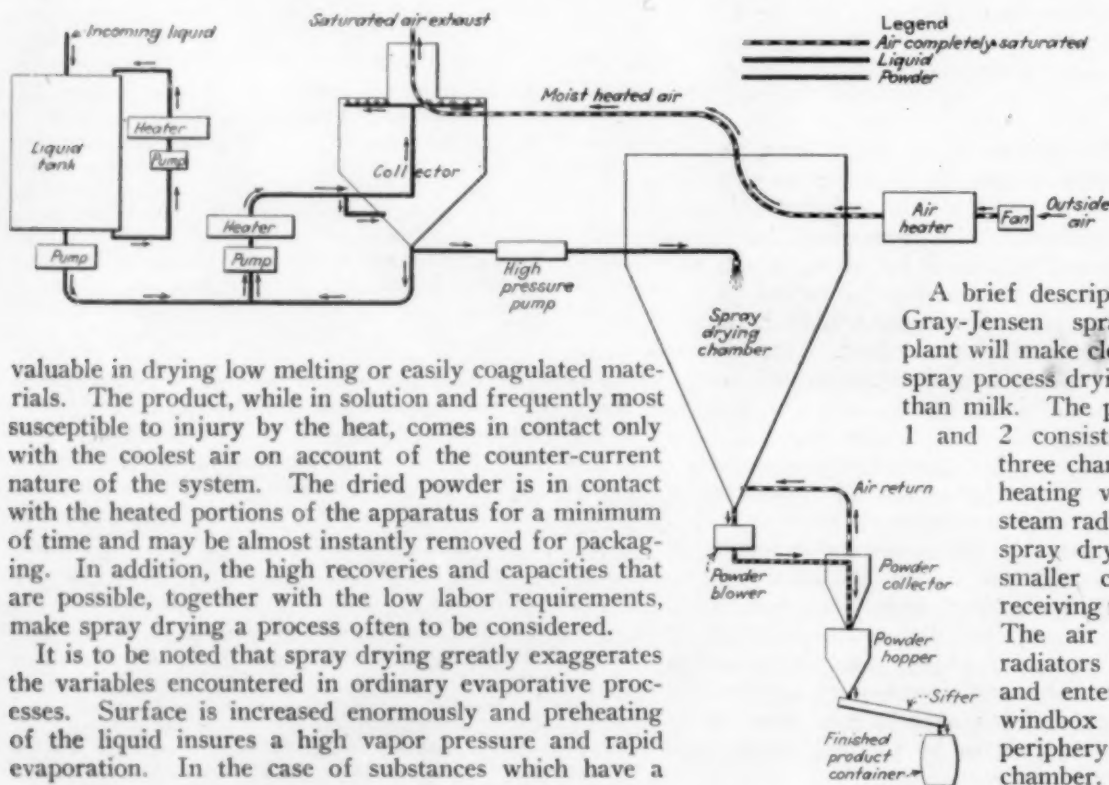


Fig. 1—Flow Diagram of the Douthitt Gray-Jensen Spray Drying System

valuable in drying low melting or easily coagulated materials. The product, while in solution and frequently most susceptible to injury by the heat, comes in contact only with the coolest air on account of the counter-current nature of the system. The dried powder is in contact with the heated portions of the apparatus for a minimum of time and may be almost instantly removed for packaging. In addition, the high recoveries and capacities that are possible, together with the low labor requirements, make spray drying a process often to be considered.

It is to be noted that spray drying greatly exaggerates the variables encountered in ordinary evaporative processes. Surface is increased enormously and preheating of the liquid insures a high vapor pressure and rapid evaporation. In the case of substances which have a

A brief description of the Douthitt Gray-Jensen spray drying process plant will make clear the adaptation of spray process drying to products other than milk. The plant shown in Figs. 1 and 2 consists fundamentally of

three chambers: a rectangular heating vault, equipped with steam radiators, a large conical spray drying chamber and a smaller conical collector for receiving the liquid to be dried. The air is blown past the radiators in the heating vault and enters a distributor or windbox around the upper periphery of the spray drying chamber.

From the windbox, air enters the drying chamber by means of slots in the wall. These slots are arranged tangentially so that the air is given a cyclonic motion of very high velocity. At the center of the chamber the rapidly whirling, heated air meets the spray of liquid. On account of the circular motion of the air currents, the particles of spray move spirally outward toward the wall of the drying chamber, becoming dry as they do so.

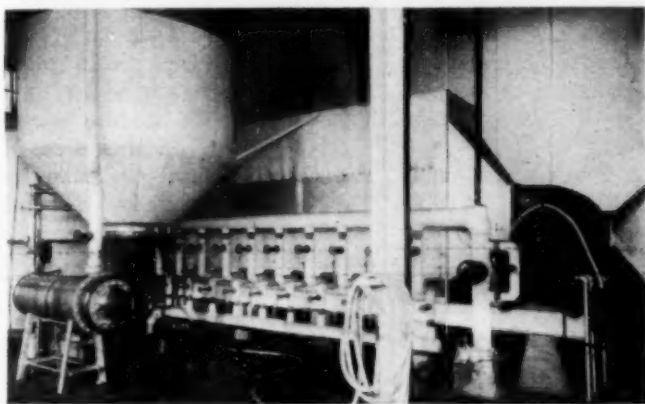


Fig. 3—View of Liquid Collector and Air and Liquid Heaters

The dry powder settles to the bottom of the chamber and is removed immediately by the powder collecting system.

The air, cooled and moistened by the evaporation of water from the spray, leaves the drying chamber and passes through the collector. Here it comes in contact with a coarse, low-pressure spray of the liquid being dried. During the passage through this second spray the air gives up any fine dust it may have carried over from the drying chamber, evaporates a portion of the water from the coarse spray and leaves by the stack, free from

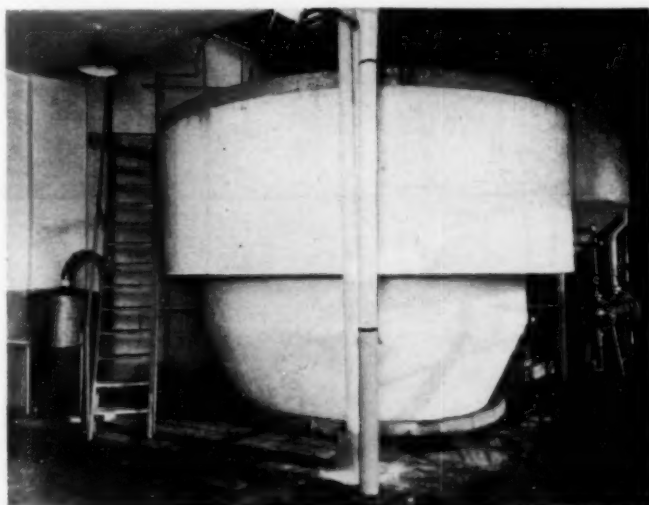


Fig. 4—Upper Part of Spray Drying Chamber and Powder Collector

powder and dust and practically saturated with moisture. Thus, the collector serves the dual purpose of filtering the outgoing air and concentrating the liquid to be dried, insuring against loss of valuable powder out the stack, making for the fullest possible use of the heat contained in the drying air and avoiding the use of unsanitary and unsatisfactory bag filters.

During the past year considerable experimental work has been done on adapting the spray drying process to products other than milk. Some of these have been very successful while others are still in the experimental stage.

Among the products worked on have been the following:

Blood Products—The production of spray-dried blood products has included whole blood, blood serum and "hemoglobin," the last being the residue from the serum separation. These experiments have been very successful and spray-dried blood products are being made on a commercial scale. Blood is a good example of a material of low coagulation temperature (160 deg. F.) that can be readily dried by the spray process.

Eggs—Egg albumin, whole eggs and egg yolks as well as various mixtures of eggs and milk have been dried without coagulation and without the powder having a cooked odor or flavor. The addition of skim milk to egg products makes drying easier and gives a powder of better texture. This is probably due to adsorption of some of the oil from the eggs by the milk. Dilution of the eggs, whether whites, whole eggs or yolks is unnecessary. This makes the yields per hour high and the cost of production per pound of powder low.

Gelatin—Gelatin has been dried successfully. The finished product is very light and fluffy. Microscopically, the particles appear like tiny balloons.

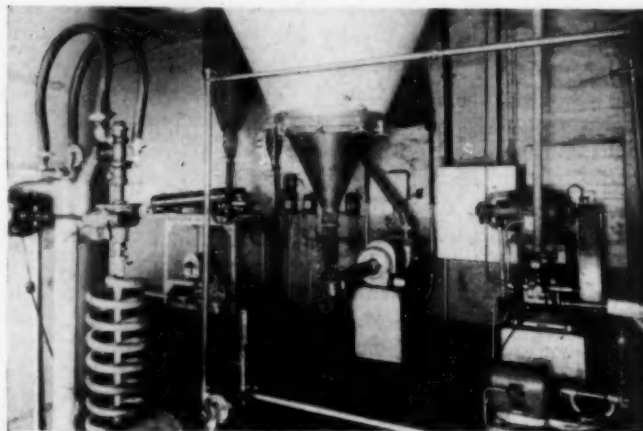


Fig. 5—View of Hydraulic Pump, Powder Blower and Sifter

Soap—Both pure soap and soap powder have been dried. The sodium carbonate in the latter appears as the anhydrous form instead of the hydrous. The powders were made from approximately 25 per cent solutions although it appears probable that soap fresh from the kettle could be used. In this case, the hourly yield would be enormous and the powder could be made very cheaply. The powdered soap was very fine and light (100 lb. per barrel). It dissolved almost instantly in water.

Vegetable Flours—Experiments have been made on both potatoes and bananas. Flour of good quality can be made from either, though there are some details in the process still to be worked out. Both products presented some difficulty in spraying on account of the high viscosity and low solids content of the suspensions of pulp.

Sugar Products—The sugars alone offer a problem of considerable difficulty on account of their high solubility and boiling point raising. However, if some colloidal material is present as a stabilizer the drying becomes much easier. Since the sugars must be obtained in the pure state by crystallization, it is usually the sugar product mixed with colloidal material that is presented as a drying problem. Thus, beverage powders containing cane sugar and cocoa, and cane sugar cocoa and milk have been dried, and in large quantities. Mixtures of sugars, even with low melting points, can be dried if sufficient colloidal material is present. A beverage powder of cane sugar, malt syrup, cocoa and milk has been

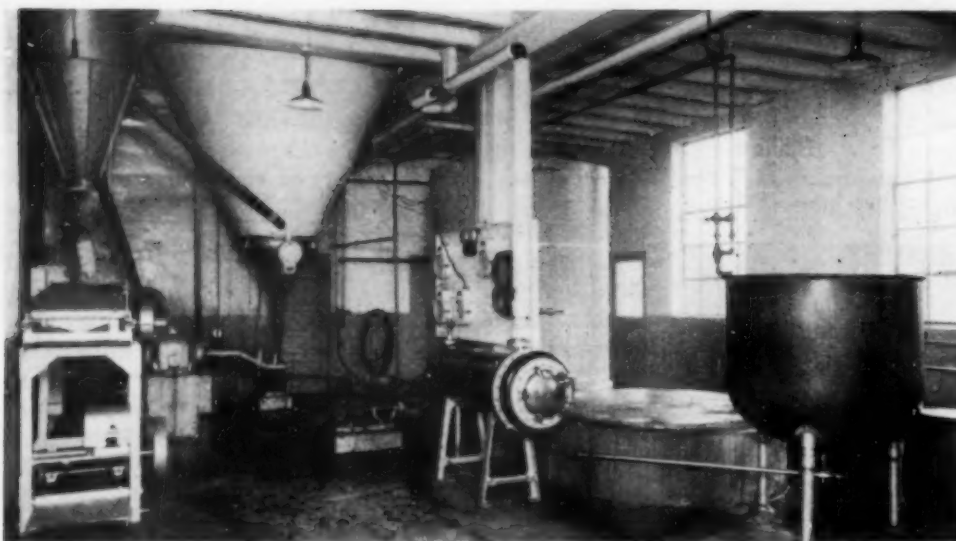


Fig. 6—From Left to Right, the Sifter and Powder Hopper, Powder Blower and Lower Part of Spray Drying Chamber, Liquid Heater and Liquid Storage Tanks

handled without particular difficulty. "Blackstrap" molasses dries quite readily by the spray process, though, so far as the writer is aware, it cannot be reduced to a powder by any other method. This statement also holds true for glucose syrup, which can be spray dried to a beautiful white powder. Malt extract powder containing approximately 75 per cent maltose is manufactured commercially by the spray process at the plant of the Jersey Products Company of Lima, Ohio. Some work has been done on crude lactose solutions. Lactose is difficult because of the ease with which it caramelizes, particularly in the presence of a small amount of acid. The preliminary experiments indicate that it probably can be dried.

Inorganic Salts—The only inorganic salt that has been spray-dried in this laboratory is sodium sulphate. This was sprayed from a 20 per cent solution and dried quite readily. The powder was 93 per cent sodium sulphate and hence was anhydrous. Plans are being made for experiments on other inorganic salts.

These examples show a few of the possibilities of spray process drying for liquids. There are of course many more. In general, it may be said that any liquid carrying solids in solution or fine suspension is an opportunity for a spray drying plant. There are some limitations, such as the presence of materials sufficiently abrasive to exert more than normal wear on pump valves and spray nozzles. Liquids of high viscosity and low solids content are difficult to handle and of course show a very low hourly yield. The process is not recommended for very cheap materials unless the output can be made great.

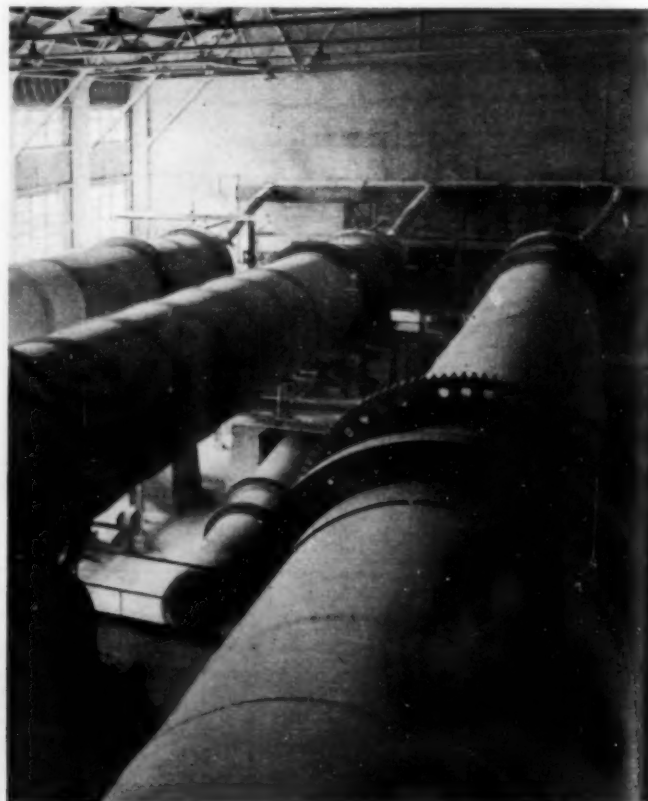


Fig. 7—Laboratory for Drying Experiment Control

On account of the low temperatures involved and their close control, the spray drying process should be of particular interest to the food and beverage industries. Successful orange and lemon beverage powders have been made by the spray methods and it is quite likely that similar results can be expected from other fruits such as apples, grapes, raspberries and the like. Vegetable juices, or mixtures of them, offer similar possibilities as flavors for soups, sauces and gravies. There are also possibilities in the cooked vegetable flour field. The opportunities in milk and ice cream, confectioners' and bakers' mixtures have not been exhausted.

Animal feed might be made by this method from waste brewers' yeast and distillers' and other industrial residues. Tanning extracts offer another possibility. Delicate pharmaceutical and medicinal chemicals may find a ready means of production by spray process methods. Rubber accelerators, such as hexamethylenetetramine, could probably be produced in this way.

Wherever it is necessary to reduce a solution or suspension to a powder, particularly if it is difficult or impossible to do so by evaporation to dryness and grinding, spray process drying should be considered as a potentially successful tool.



One of the Largest Pieces of Gas-Welded Equipment Ever Built
This rotary kiln, 8 ft. x 125 ft. in size, proves that welding has reached the field of heavy moving machinery. It resulted in construction that reduced cost, produced a lighter shell and lessened danger of shell distortion.

German Practice in Recovery of Wool Grease

Ernest Wolff,

Gartwood, N. J.

EDITOR'S NOTE—Periodically, proposals are brought forth in the United States for the recovery of wool grease from waste waters of wool washing plants, as a commercial means of manufacture of lanoline. Several years ago a co-operative effort of this sort was made in Rhode Island as a paying method of avoiding stream pollution. The entire situation was competently analyzed and seemed to have good possibilities of success. The scheme never reached the operating stage.

IN THE PREPARATION of wool for textile processes, such as dyeing, the material must first be scoured to remove dirt, grease and miscellaneous matter. The waste scouring liquors are often discharged into streams as a means of disposal. Prevention of stream pollution by waste from textile processes is a matter that will grow in importance as time goes on. During the war, when the price was abnormally high for a good product, wool grease was recovered from the textile scouring waters by the use of centrifuges. The process has, for the greater part, now been discontinued. In contradistinction, wool scouring plants in Germany have developed a different technique, which has been in use for a long time.

The alkaline soap liquors, in which the raw wool was scoured, are mixed with sulphuric acid and run into successive pits through which they flow continuously. A sludge containing the wool grease, the fatty acids of the soap, and most of the dirt of the wool separates. The sludge settles and gradually fills the pits. It is pumped into a brick-lined tank, where it is heated previous to passage through filter presses to reduce the water content. The filtered mud is further heated and run into extraction apparatus where it is treated with benzene. Ordinarily five successive extractions are necessary to recover all the grease from the mud. The first two washings or extractions contain most of the grease. These are pumped to a storage tank. The last three washings are low in grease content but are re-used for further extraction. The storage tanks are upright cylinders, with conical bottoms. The tank outlets are arranged some distance above the bottom to allow for space into which the mud can settle. Two tanks are provided, being alternately for collecting and taking out the "strong" solution.

WEAK SOLUTIONS from the third to the fifth washings of the sludge after filtering are used for extraction of untreated material. The solvent remaining in the mud after extraction is recovered by steaming, the steam and vapor being condensed by coolers. The benzene is separated from the water and returned to the benzene storage tank.

The clear benzene solution of the crude grease after settling is used for the manufacture of neutral grease and fatty acids. Neutral grease is made from the crude grease by refining with caustic soda and alcohol. Saponification of the fatty acids of the crude grease is done in a closed system. Caustic soda solution of 30 deg. Bé. is added till a sample shows distinct alkalinity when tested with phenolphthalein. The liquid is heated and sufficient 50 per cent alcohol is added until

the alcoholic solution of the soap and the benzene solution of the now neutral grease are definitely separated. These solutions are allowed to stand until settling is completed. The benzene solution of the neutral grease is then drawn off into a washing kettle and washed with 50 per cent alcohol. The alcoholic soap solution remaining in the saponifying apparatus, is washed twice with benzene. These two wash solutions after settling are drawn into the washing apparatus. Here they are washed by 50 per cent alcohol in the same manner as the original benzene solution.

The alcoholic solution remaining in the saponifying apparatus, is washed twice with benzene. The two wash solutions are pumped into another piece of the equipment quite similar to the saponifying apparatus, where these solutions are treated with the alcohol that remains when the original benzene solution of the neutral grease is washed with the pure 50 per cent alcohol as described above. The benzene extractions are washed successively. The first which is drawn is run into the tank of the neutral solution; the second is run into another tank and used for washing alcoholic soap solutions in the next cycle of the process. The alcohol in the washing apparatus is pumped to a tank connected with the saponifying apparatus. It is used for washing out the soap after a new portion of the crude grease solution has been neutralized.

After the alcoholic soap solution in the saponifying apparatus has been treated with benzene, it is pumped into a lead-lined, covered vessel where it is decomposed by 33 deg. Bé. sulphuric acid until the fatty acids have been separated. The supernatant fatty acid layer is drawn off. The acids still contain considerable benzene. This solvent is recovered in a distilling apparatus and the fatty acids obtained. The underlying layer consists of water and alcohol. This is pumped off and the alcohol recovered by distillation. The sulphuric acid decomposing apparatus is so arranged as to permit the tapping off of various layers of the solution and separated portions.

NEUTRAL grease is produced from the evaporation of the clear benzene solution, the benzene being recovered in a distilling apparatus, the fat or neutral grease remaining in the equipment. Lanoline (*Adeps lanae anhydrous*) is made from the neutral grease solution by evaporation to about 0.8 specific gravity. The solution is bleached by successive treatment with fuller's earth, or other bleaching material. The solution is then distilled to recover the benzene. Before all the benzene is evaporated the solution is washed by alcoholic lye and distilled water to remove all traces of the fatty acids. The rest of the benzene is then evaporated. The grease or lanoline is pumped into an aluminum apparatus which connects with an air pump or two pipe lines, one pipe allowing the air to enter the grease and the other for low-pressure steam. First, air is passed through the grease at a temperature of about 170 deg. F. and at a vacuum of two inches for two hours. The air cock is then closed and the steam is passed through at a vacuum of 3 in. for 24 hours. This operation is really one of deodorizing. The finished product is then packed in the proper containers and sent to the market.

Wool grease recovery in Germany is, depending upon the conditions, a profitable operation. In America the operation might prove to be of interest, not so much from the standpoint of the recovery of wool grease, but rather as a means for the prevention of waste pollution of streams.

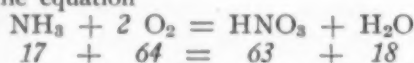
Concentrated Nitric Acid Directly Attained in Pressure Synthesis

European process in operation at Novara is outcome of industrial research and development of resistant chromium alloys

By *Giacomo Fauser*

*Industrial Engineer,
Novara, Italy*

PRODUCTION of nitric acid by the oxidation of ammonia does not result directly in high concentrations. Theoretically it should be possible to obtain an acid titrating 77.7 per cent, according to the proportions of the equation



Various factors however prevent the formation of this concentration. It should be

remarked, to begin with, that in the oxidation of ammonia one must be satisfied with a yield of 90 per cent, especially since the recovery of the last traces of nitric oxide can be accomplished effectively only by an alkaline solution, which removes more HNO_3 , proportionately, than water. If, for example, the proportion of oxides of nitrogen absorbed by soda is 10 per cent and the efficiency

of the oxidation is 90 per cent, then the total efficiency is reduced to 81 per cent, and in this case, the theoretic concentration of condensed acid, without addition of water, would be 71 per cent.

But apart from these aspects, the conditions of equilibrium allow of no such high results. Many experiments, unfortunately at variation in attendant conditions, indicate at least that because of numerous factors (such as the proportion of NO , the time of contact, and so forth) the equilibrium is attained with an acid of 60 per cent. Even this cannot be reached industrially, because the equilibrium requires many hours of contact.

The necessity for washing with very weak acid represents a further reduction below this figure. Again the absorption of the vapors at ordinary temperatures is slow when the absorbing acid is as high as 50 per cent, whereas at rising temperatures the lower oxides begin to reduce the nitric acid.

As a result the practical limit for condensed nitric acid is about 50 per cent, even if unlimited amounts of gas could be passed through. Since this acid, though, is too dilute for a number of industrial applications, it is necessary to resort to concentration. The industrial method

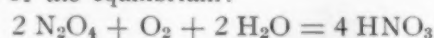
of accomplishing this is the distillation of a sulphuric-nitric acid mixture. The limit here is 68 per cent, by simple heating. One must then employ a dehydrator, usually concentrated sulphuric acid, which retains considerable quantities of water at the distillation temperature of nitric acid.

In any event, this concentration is a costly operation, because materials must be used which will resist both

sulphuric and nitric acid. There is a considerable consumption of fuel; large quantities of sulphuric acid are in circulation and require expensive apparatus for storage and reconcentration; and there is a sensible loss of the acid itself in the process of reconcentration.

With a view to obtaining higher concentrations of nitric acid directly, the author studied the effect of pressure on the equilibrium below.

Since the reactions in this system are really equilibria between water and various oxides of nitrogen and hence subject to the law of mass action, it was logical that an increased pressure of O_2 should favor the formation of HNO_3 . And from an industrial point of view it was especially important that pressure would hasten the attainment of the equilibrium:



Since the industrial application of pressure to nitric acid production was a relatively unexplored field, it was first necessary to undertake a series of determinative experiments.

The first problem was to produce oxides of nitrogen under pressure on a large scale. It was not feasible, for constructional reasons, to compress the gases after the oxidation of ammonia. The oxidation of ammonia under pressure then seemed the logical solution.

It was found, in oxidizing ammonia with a platinum catalyst, that while the reaction curve with temperature in oxidation under pressure is similar to that under atmospheric conditions, the reaction in the direction of nitric oxide rather than free nitrogen is favored as the temperature exceeds 400 deg. C., reaching its optimum at 850 deg. Using air for the combustion the heat of the reaction at the catalyst runs up to 735 deg., and in order

European nitrogen fixation, developed by Haber and Bosch, Fauser, Claude and others, has been eminently concerned with the fertilizer problem. One of these pioneers, in his paper before the Adriatic Nitrogen Conference, now describes a working plant for nitric acid synthesis,—a sign of the growing attention to broader industrial fields for atmospheric nitrogen.

to avoid the complications of supplementary heating it was found preferable to increase the oxygen (and ammonia) content sufficiently to produce 845 deg. C. The time of contact with the catalyst must be long enough to let all the ammonia oxidize. The efficiency of the conversion seemed to be the same with and without pressure, but the industrial advantages of pressure become evident by the following comparison:

	Tons NH ₃ Oxidized Per Day Per Sq.M. Platinum Gauze	Kg. HNO ₃ Produced Per Day Per Gr. of Platinum	Per Cent Yield
Without pressure	0.7	2.76	91.6
5 atm. "	3.3	12.8	91.2

The remarkable economy in platinum is obvious. It should be further noted that where oxygen is plentiful, as in ammonia synthesis, its use in the mixture will also permit an increased ammonia content and a higher concentration of nitric gases.

Transformation of the oxides of nitrogen into nitric acid, by means of water, is swifter the higher the degree of oxidation of the nitrous vapor. For every three molecules of N₂O₄ reacting, two are absorbed and only one must be reoxidized: therefore with four cycles an absorption of 90 per cent of the total N₂O₄ is reached. If it is a question of absorbing N₂O₃, ten cycles would be necessary to arrive at the same result, and therefore the volumes of absorption would be much greater. Extensive experiments revealed an enormous influence of pressure on the oxidation of NO: whereas at atmospheric pressure it required 1,200 seconds to transform 98 per cent of NO into NO₂, only 59 seconds were necessary to obtain the same result under 5 atmospheres. It may be said that the speed of this peroxidation increases practically with the square of the pressure.

The absorption of NO₂ by water has been the subject of much discussion, but the fact that the absorption thrives with low temperatures indicates that this is due to the polymerization to N₂O₄. The formation of

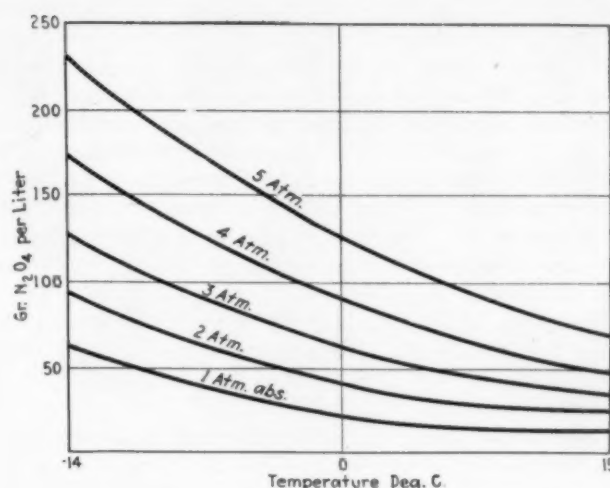


Fig. 2—Effect of Temperature on Absorption of N₂O₄ under Various Pressures

N₂O₄ and its absorption in water are greatly hastened by pressure, as might be expected. At the same time the absorption slackens as the acid increases to a strength of 42 deg. Bé., after which simple solution takes place. The conversion of absorbed peroxide and oxygen into nitric acid is also hastened by pressure: thus in a test at 50 deg. C., after 3 hours only one-third as much N₂O₄ remained when under a pressure of 6 atm. as under 1 atm. The results of the test are shown graphically in Fig. 1.

For industrial purposes it was found that when vapors were to be absorbed, the temperature should be as low as possible; when peroxide is to be further oxidized by compressed oxygen the temperature should be as high as compatible with the steel containers, that is, about 50-70 deg. C. These results were kept in mind in the design of the industrial installation described further on in this paper.

ANOTHER considerable advantage in the use of pressure is the increased thermal conductivity, which permits a reduction in the dimensions of the refrigerators. It has been seen that the efficiency of the gas absorption is dependent upon the rapid and complete removal of heat from the gases leaving the converters. The equipment normally necessary for this would rival a battery of absorption towers. From tests and calculations it was found, however, that an increase in pressure from 1 to 6 atm. would reduce the necessary cooling surface in a ratio of 4.5 : 1.

A point sometimes cited against the process of oxidation under pressure is the high power consumption for compression. This energy can be calculated with sufficient accuracy and one finds that it represents a very moderate expense in the production of nitric acid. Thus, in the process under pressure, a kg. of HNO₃ (calculated at 100 per cent), represents a consumption of slightly less than one-third kw.-hr. But even here a large fraction of the energy may be re-utilized by exploitation of the residual gases, for example in a motor applied to the compression itself.

It is evident, then, that the different phases of the nitric acid production—that is to say, the oxidation of ammonia and NO, and the subsequent reaction of the vapors with water—are all favored by an increasing pressure. It was hence of especial interest to apply the process industrially.

The experimental work described here enabled the author to construct an installation operating under a pres-

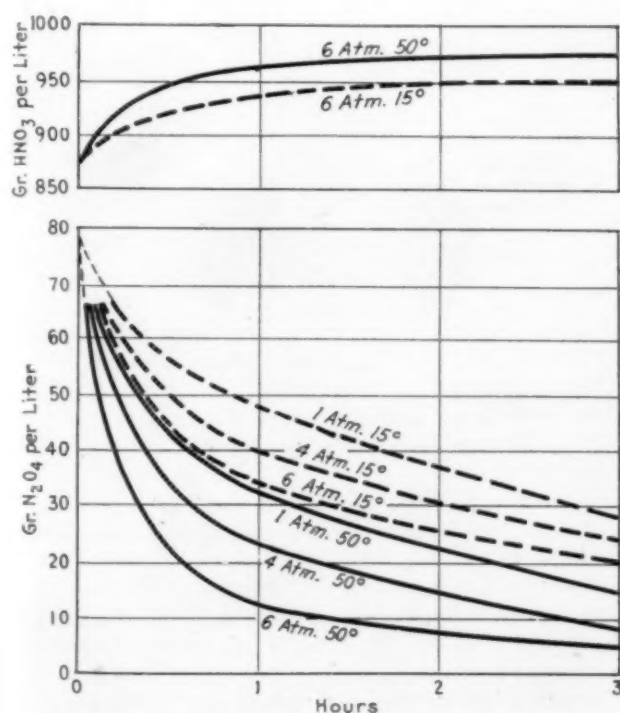


Fig. 1—Effect of Pressure on Conversion of N₂O₄ into HNO₃

sure of 5 atm., the results of which have quite fulfilled previous expectations.

A general idea of the arrangement of the various units is given in Fig. 3. A system of valves *M* and *N* allows the supplying of ammonia and air, enriched with O_2 , to the compressor *B* in the desired proportions. The compressed mixture is carefully filtered in *C* to free it of any trace of lubricant, and from there it is forced into the converter *D*. The vapors leaving at a high temperature are sent to the heat-exchanger *E* to reheat the residual gases.

The gases leaving the heat-exchanger are cooled again in the refrigerator *F*. The condensed water-vapor from the reaction is separated in the chamber *I* in the form of weak nitric acid, which is then sent on to the top of the absorption-tower *L*; meanwhile, the gases pass into the oxidation-chamber *H*. Here the transformation of NO to NO_2 and the polymerization into N_2O_4 take place. In this condition the gases are sent to the bottom of the reflux column *L*, which is kept well cooled.

The bubbling of the gases in the liquid is regulated by a system of covers with dentated edges, while plunger tubes, reaching down from one section to the next, ensure a constant liquid level and act as hydraulic seals.

The weak solution, descending from the top and reacting with the nitrous gases, becomes increasingly enriched with nitric acid, until it attains a concentration of 41-42 deg. Bé.; beyond this limit, due to the elevated pressure and low temperature, there is a physical solution of nitrogen peroxide in the acid.

The solution leaving the absorption column, warmed back to about 40 to 50 deg. C., is sent on to the reaction column *P*. Compressed oxygen is introduced at *Q*, the N_2O_4 reacts with the water (in excess), and concentrated nitric acid is formed.

The excess oxygen is sent to the oxidation chamber through *T*. In order to obtain concentrations above 44 deg. Bé. it is necessary to remove a certain amount of weak acid at the valve *O*. The residual gases leaving the absorption column are returned to the heat-exchanger *E*, where they are raised to about 300 deg. C. Their expansion is then utilized in the motor *S* connected to the compressor *B*, whereby the consumption of energy for compression is reduced.

The photographs shown in this connection are views of the installation operating in the plant of the Società Italiana Ammonia at Novara. In Fig. 4 is shown a compressor designed to compress 2,000 cu.m. of the mixture air-ammonia to a pressure of 5 atm.; it is connected with a motor driven by the heated gases. Fig. 5 reproduces the oxidation room, where four converters operating under pressure are installed. Especially to be noted are the slight dimensions of the apparatus as compared with its capacity, which is found to be 2,500 kg. of 100 per cent HNO_3 each day.

But above all, there is an enormous reduction in the absorption apparatus; a simple comparison will readily reveal this. Fig. 8 shows the absorption towers of ordinary plant capable of producing 10 tons of HNO_3

(100 per cent) a day, while in Fig. 7 is the absorption installation at Novara, working under pressure and having the same capacity. By way of approximate comparison it may be said that the ratio of the spaces occupied is about 20 to 1.

Regarding the costs, it would be no exaggeration to say that the price of installation of apparatus under pressure, inclusive of the compressors and motors, is less than a half of that of the customary plant.

In order to start the converters, after the flow of air and ammonia has been regulated, it is necessary only to adjust an electric switch; the flow of the process then proceeds automatically, requiring practically no attention.

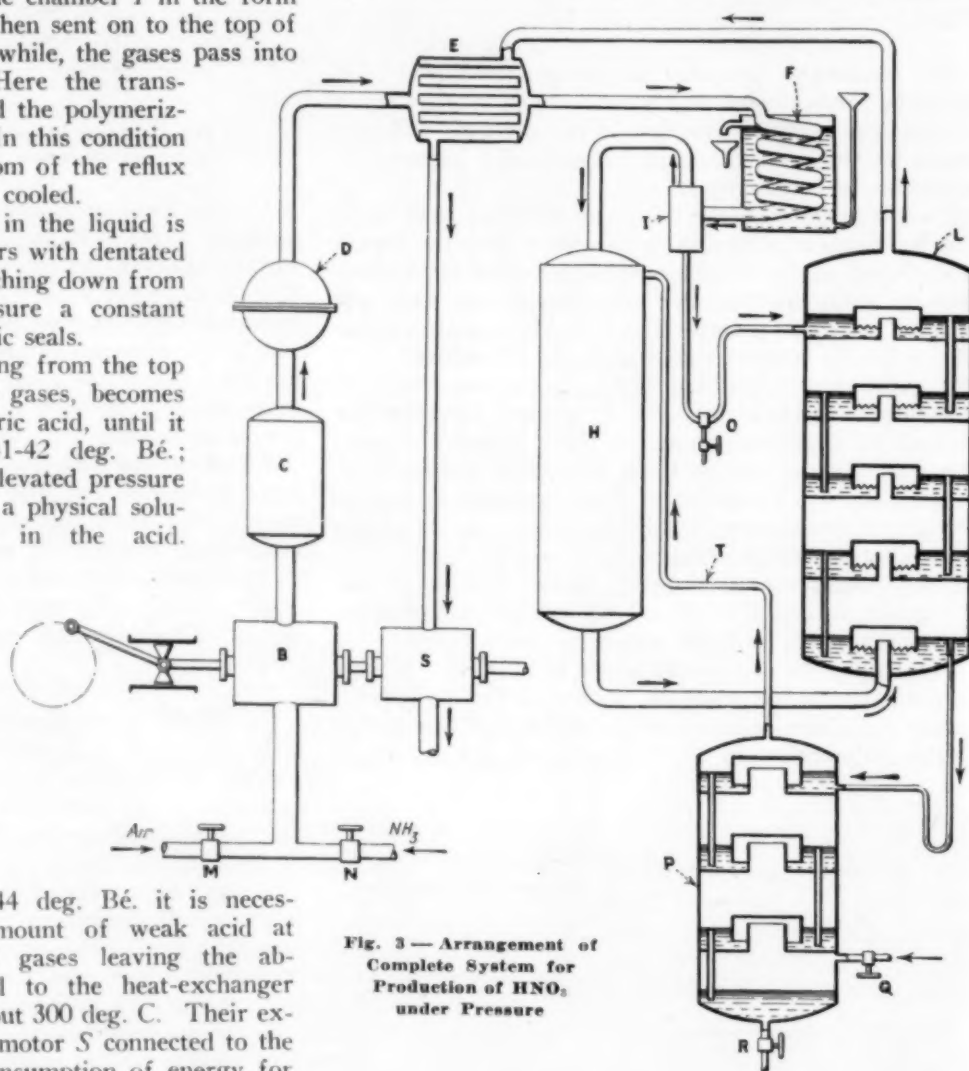


Fig. 3 — Arrangement of Complete System for Production of HNO_3 under Pressure

Recording instruments continually indicate the ammonia content, and interrupt the process when any exceptional variation occurs.

Without wishing to enter further into practical details, the author would like to mention a few of the interesting results obtained:

The efficiency of the conversion was found to be over 91 per cent, that is, practically equivalent to installations without pressure.

The absorption is perfect. When the concentration of the acid is in the neighborhood of 42 deg. Bé. the proportion of oxides of nitrogen in the alkaline absorption is less than 2 per cent.

The gases leaving the last towers are practically free of oxides of nitrogen. Since they contain only 2 to 3

per cent oxygen, they can be profitably employed for the production of the pure nitrogen necessary in the ammonia synthesis.

BEFORE bringing this paper to a conclusion it seems desirable to say a word on the chromium steels that render such high services in the nitric acid industry and without which it would be almost impossible to overcome the problem of absorption by pressure.

The essential difficulties in regard to apparatus concern its resistance to the pressure employed and to the attacks of the acid; at the beginning they gave rise to very disappointing results. It was found that the mechanical properties of ferrosilicons and quartz, despite their successful applicability elsewhere in the chemical industry, made their use in this direction quite unsatisfactory.

The chromium steels finally offered the real solution to these obstacles. They have good mechanical properties: when the carbon content is less than 0.1 per cent the steel is very malleable and can be plated, worked and sweated, thus qualifying well for the pressure equipment. Furthermore, their great heat conductivity gives them a superiority over ferro-silicon when used in coolers.

Regarding their chemical resistance, which by many is still considered insufficiently proven for nitric acid, it may be remarked that the chromium steels have been known for a long time and that it is their technology and production that have made such great strides recently.

Tests made on numerous samples in this connection have given complete satisfaction. For example, the percentage composition of a certain steel was $C = 0.1$, $Cr = 0.18$, $Ni = 6$, $Si = 0.4$, $Mn = 0.25$, $P = 0.025$

and $S = 0.025$. Its elastic limit at 20 deg. C was found to be 20 kg. per cu.mm., its breaking stress 65 kg. per cu.mm., and its elongation 57 per cent.

Two samples, one with a polished and the other with an oxidized surface, were treated with 30 deg. Bé acid, since acids attack more readily when dilute than when very concentrated. For 24 hours at first the test was carried on 400 hours at 30 deg. C. The results obtained are expressed by the curves in Fig. 6. Another sample, having been heated to 1,100 deg. C., and then in contact with 35 deg. nitric acid at 50 deg. C. for two months, lost only 28 mg. per sq.dm. Examining the curves one finds that there is always a noticeable loss at the beginning, and that the attack then becomes slower.

The porosity, presence of impurities and homogeneity all affect the metal's chemical and mechanical behavior, and any treatment reducing the porosity will also hinder the advance of corrosion.

Everything considered, the manufacture of steels resistant toward nitric acid seems to be at a satisfactory stage, awaiting only such improvements as further experience will tend to suggest. By submitting the equipment to methodic observation in service and by carefully inspecting all cases of deterioration, one may expect research to clarify the anomalies still existing.

The study offered in this paper points, then, to the conclusion that the aid of pressure in oxidizing ammonia yields significant advantages such as those shown in Figs. 7 and 8 on the next page.

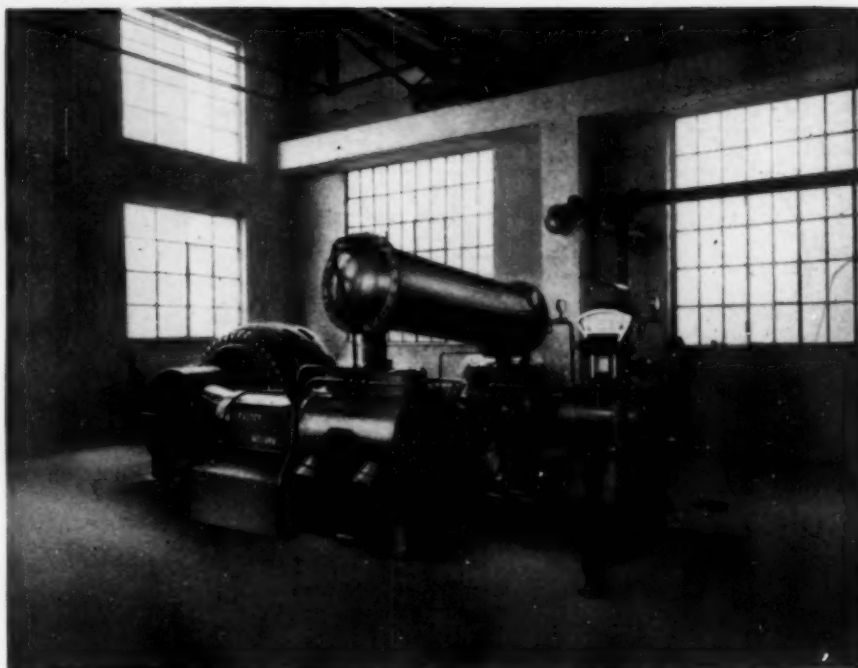


Fig. 4—Compressor Designed to Compress Air-Ammonia Mixture to Five Atmospheres

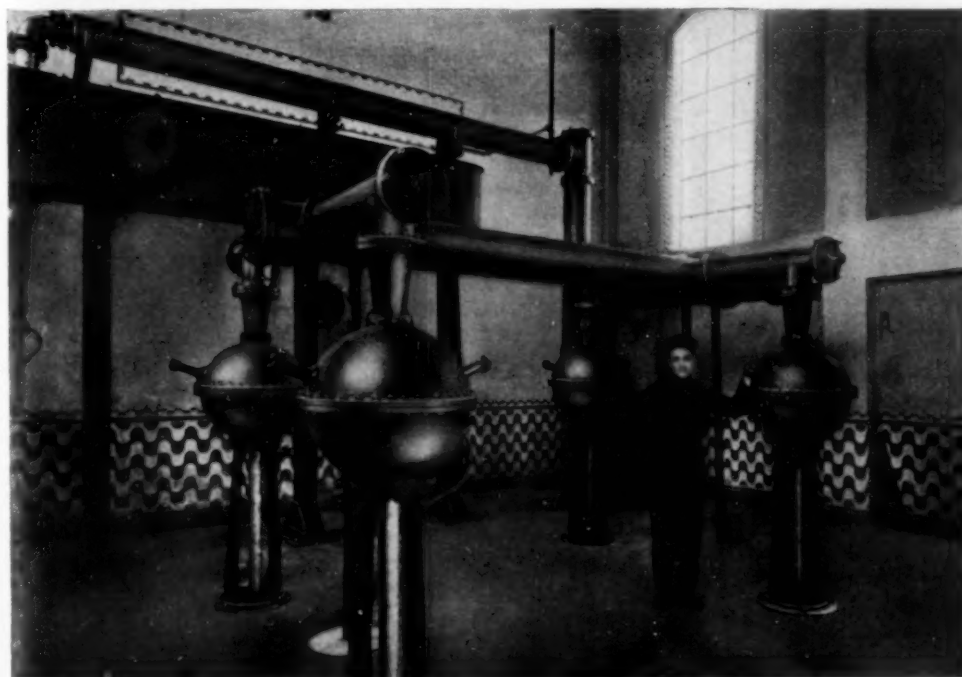


Fig. 5—Oxidation Room With Four Converters Operating Under Pressure

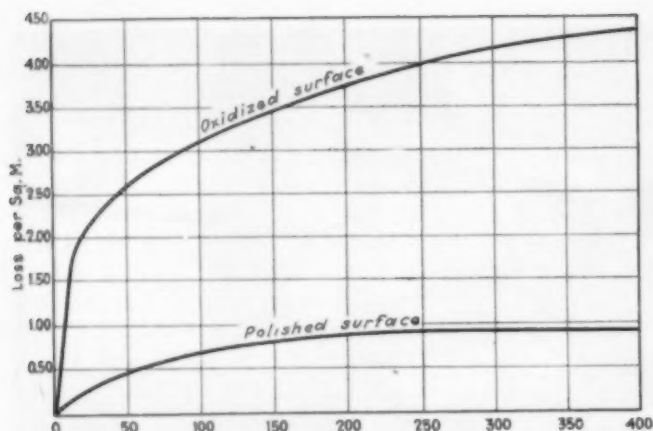


Fig. 6—Corrosion Curves Displayed by Two Samples of Alloy Suspended in Boiling 36 Deg. Acid for 24 Hours and at 36 Deg. C. for 400 Hours

The speed of oxidation of the vapors increases rapidly and the absorption becomes easier as the pressure rises. The difficulties offered by the equipment are practically solved. Experience has shown that misgivings as to the tightness of joints were unfounded, since the tightness of a joint depends far more upon its size than upon the pressure which it has to withstand. At five atm. the cross-section of the lines is reduced to one-sixth, hence, all else remaining the same, the apparatus is very much easier to construct.

Of course it is necessary to know how to conquer all the difficulties of sweating and welding—difficulties aggravated by the nature of the metal employed. These difficulties can be dispelled only by experience within



Fig. 7—Absorption Tower at Pressure Plant in Novara with Same Output as Normal Battery in Fig. 8

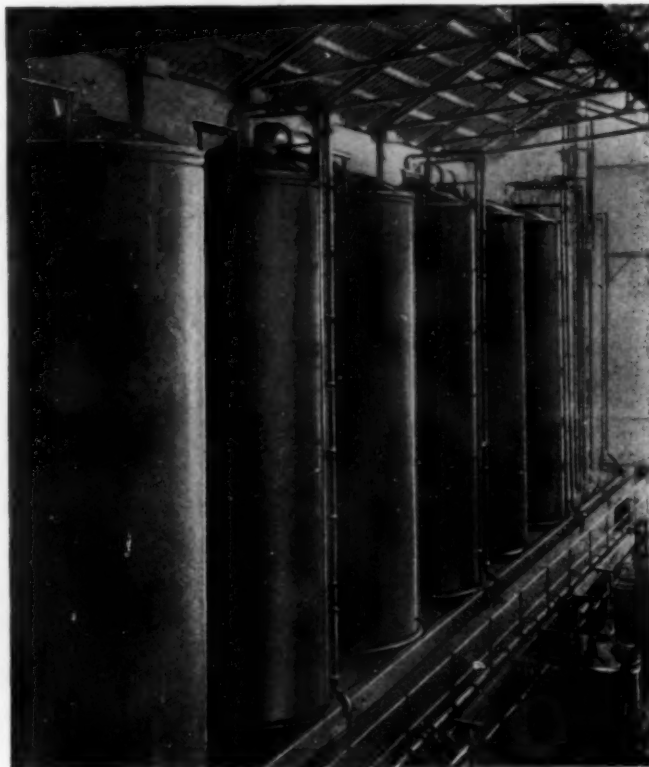


Fig. 8—Battery of Columns Necessary to Equal Under Atm. Pressure the Output of Tower in Fig. 7

the scope of industrial efforts, but the major portion may today be happily regarded as being overcome.

The slight additional work necessitated by the pressure is largely balanced by the installation costs, the concentration of the acid, and the convenience.

From the standpoint of energy consumption it is also well to remember that, if one's objective is not the production of ammonia and if there is a sufficient quantity of byproduct oxygen at one's disposal, the residual gases leaving the system can be sent back to the converters without renewed compression. The alkaline absorption is then obviated and it is necessary to compress only the ammonia-oxygen portion. Under these conditions the costs of compression would be reduced very considerably below those calculated for just the ammonia-oxygen mixture.

Construction of a number of industrial plants has been undertaken, and several are already operating in a thoroughly satisfactory manner. In one installation an acid of a concentration around 44 deg. Bé. is obtained, a result considered almost impossible a few years ago. Its operation was just as easy and normal as in the process under ordinary pressure.

For concentrations higher than 44 deg. Bé. one could distill a sulphuric-nitric acid mixture, and in this case the amount of sulphuric acid necessary for dehydration would be reduced to one-fourth of that at 36 deg. Bé. Simple distillation of 44 deg. acid in a reflux condenser would also serve in concentrating, since the vapors of a mixture stronger than 68 per cent are richer in acid than the liquid.

There is, finally, the possibility of synthesizing directly acids of a higher concentration, since there are no theoretic, but only technological, difficulties in the way of this, as yet. In any event it may be safely claimed that the technology of producing nitric acid under pressure has already won a firm position in industry on the Continent.

New Data on Oxygen Concentration for Explosion Prevention

By P. W. Edwards and R. W. Harrison

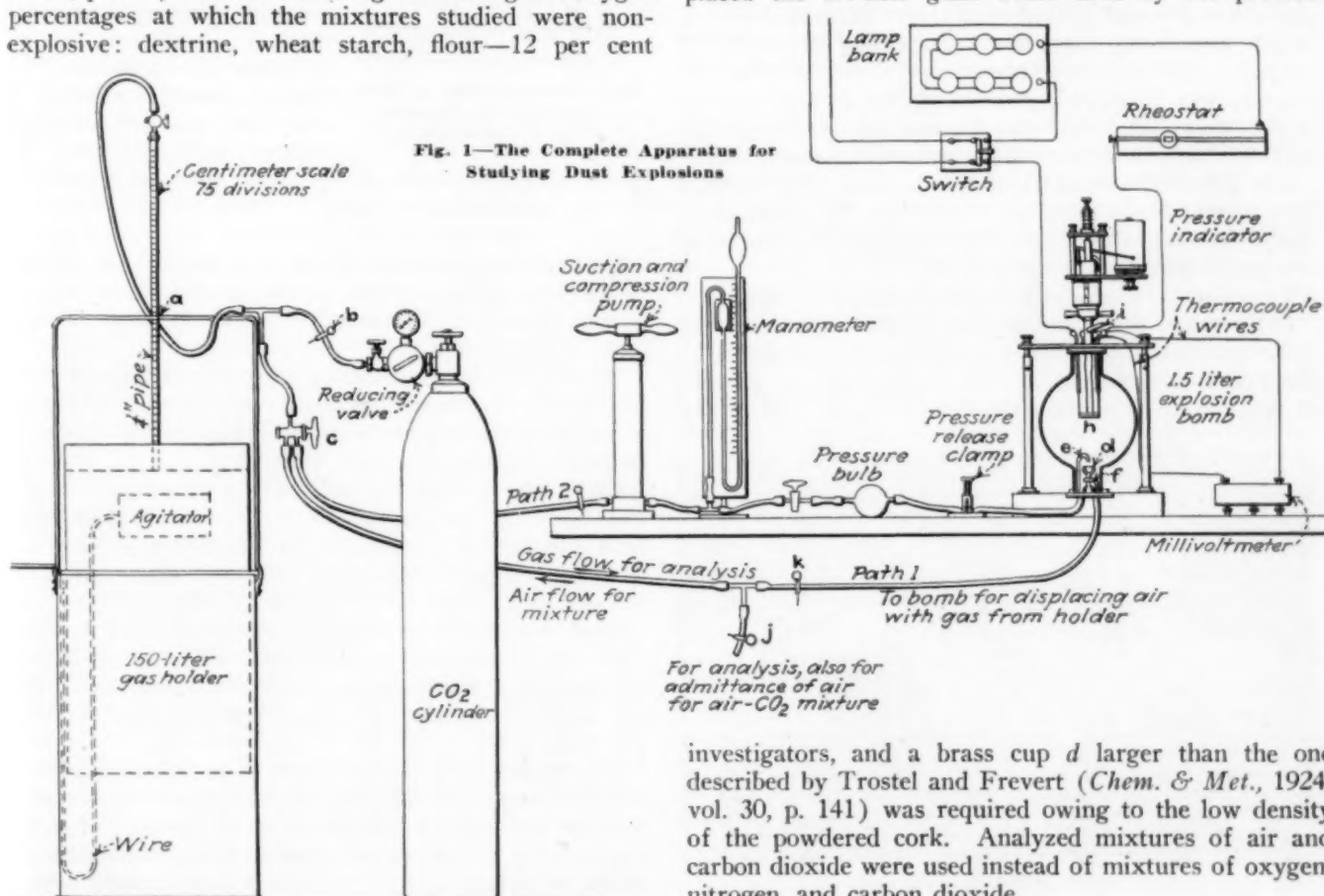
U. S. Bureau of Chemistry and Soils, Chemical Engineering Division,
Washington, D. C.

WHEN finely divided and suspended in air in sufficient concentration, most organic materials, sulphur, and a few metals form explosive mixtures. In processes where grinding, pulverizing, screening, air separating, conveying, and dust collecting are necessary, a distinct dust explosion hazard is produced (see *Chem. & Met.*, March, 1928, pages 150-152). In order to eliminate this hazard a number of plants have confined these dust producing operations to inclosed systems, within which a so-called inert atmosphere is maintained. Flue gas having a low oxygen content is generally used to produce the inert atmosphere.

Experimental investigation of the maximum safe proportion of oxygen in the gas and dust cloud is of great importance in the design and operation of inert gas systems from the standpoint of both safety and economy. These proportions have been determined for several cereal dusts, one coal dust, sulphur, and hard rubber dust. Brown and Clement found (*J. Ind. Eng. Chem.*, 1917, vol. 9, p. 347) that the following are the highest oxygen percentages at which the mixtures studied were non-explosive: dextrine, wheat starch, flour—12 per cent

oxygen; oat and corn elevator dust, wheat elevator dust—14 to 14.5 per cent oxygen; standard Pittsburgh coal—16 per cent oxygen. Price and Brown (*Dust Explosions*, p. 95, N.F.P.A., Boston, 1922) confirmed these results, using an inclosed milling unit operating with fine cornstarch and dextrine, but they recommended the use of 12 per cent oxygen as a margin of safety. Frevert (*Chem. & Met.*, 1924, vol. 31, No. 23, p. 894) found that operating in an atmosphere containing less than 8.5 per cent oxygen with sulphur and less than 13 per cent oxygen with hard rubber would eliminate the danger of dust explosions. The purpose of the work reported in the present paper was to determine the oxygen dilution necessary to prevent explosion of ground cork, ground pyrethrum flowers, and ground oat hulls.

The apparatus used (Fig. 1) and the methods followed in making these determinations were essentially the same, with a few exceptions, as those described by Brown and Clement, and by Frevert. A 1.5-liter bronze bomb replaced the 1.4-liter glass bomb used by the previous



investigators, and a brass cup *d* larger than the one described by Trostel and Frevert (*Chem. & Met.*, 1924, vol. 30, p. 141) was required owing to the low density of the powdered cork. Analyzed mixtures of air and carbon dioxide were used instead of mixtures of oxygen, nitrogen, and carbon dioxide.

Briefly, the gases of desired proportions were mixed in the gas holder; measurement of the quantities of gas admitted to the holder was facilitated by the calibrated scale on the pipe leading to the holder. A pressure of 0.2 lb. per sq.in. on the bell of the holder permitted a uniform flow of gas from the gas container through the apparatus. The pump was used to place the gas in the small pressure bulb under a pressure of 20 cm. of mercury. The dust in the cup *d* was blown into suspension when the pressure clamp was released, causing a flow of gas from the pressure bulb through the tube *e* into the cup. The electrically heated source of ignition *h* in the modified Clement-Frazer bomb consisted of a baked lavite core having 48 threads per inch. It was wound with No. 30 B. & S. gage platinum wire, covered with alundum cement, and baked at 1,000 deg. C. The unit was encased in a sheet platinum cylinder. The temperature of the unit was regulated by a variable resistance in series with the unit and measured by a thermocouple in contact with the heating unit.

IN MAKING the tests the weighed sample of dust was placed in the cup, the bomb was clamped in position, and the air in the bomb was replaced by gas from the holder. Preliminary work showed that about 6 liters of gas from the holder was required to displace the air in the bomb. While the air in the bomb was being displaced the temperature of the unit *h* was raised to 1,050 deg. C. The gas inlet and outlet to the bomb were closed, the dust was thrown into suspension and ignited, and the resulting pressure was recorded on the indicator chart.

The explosibility, measured by the pressure developed in the bomb on explosion, was determined for the several dusts when weighed quantities of the dusts were blown into suspension and ignited in mixtures of air and carbon dioxide containing successively decreasing quantities of oxygen. The oxygen content was observed when no pressure was developed, and the highest oxygen content of the unexploded dust-gas mixture was taken as the oxygen dilution necessary to prevent an explosion.

The 200-mesh fractions of the moisture-free samples were used. Since these are finer than the dusts ordinarily formed, the data obtained provide additional safety for actual plant operations.

The general program of the determinations follows:

(a) Each of the three dusts was exploded at increasing concentrations in a bomb containing a gas mixture in which the oxygen was not diluted enough to prevent an explosion, as determined by previous tests. The

greatest explosive pressure produced determined the maximum explosive concentration for each dust.

(b) The oxygen dilution necessary to prevent an explosion was determined for each of the three dusts by using the concentration of dust giving the maximum explosive pressure and decreasing the quantity of oxygen in the gaseous mixture until no pressure was developed when the usual tests were made.

Figure 2 shows the results of the tests to ascertain the quantity of dust required to produce the maximum pressure under the given conditions. The maximum explosive

pressure for cork in an atmosphere containing 16.03 per cent oxygen was obtained when a 300-mg. dust sample was used, which corresponds to a dust-in-gas concentration of 200 mg. per liter. Likewise, a 350-mg. sample of ground pyrethrum flowers, corresponding to a concentration of 233 mg. per liter, produced the greatest pressure in an atmosphere containing 16.72 per cent oxygen. A 500-mg. sample of oat hulls, equivalent to a concentration of 333 mg. per liter, produced the greatest pressure in an atmosphere containing 17.60 per cent oxygen. Other tests showed that the maximum explosive concentration was practically independent of the percentage of oxygen present, provided there was sufficient oxygen to cause an explosion. To obtain a uniform mixture of dust and gas is extremely difficult, especially when the quantity of dust is large. This fact must be considered in any correlation of data.

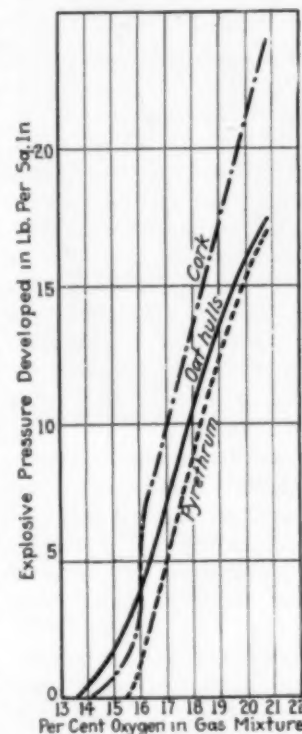


Fig. 3—Explosibility of the Several Dusts in Varying Oxygen Concentration

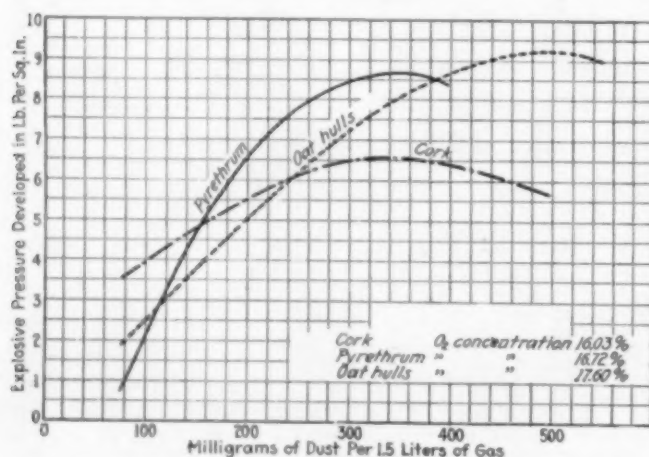


Fig. 2—Dust Concentrations to Give Maximum Explosive Force

ACLOSE correlation between volume and surface of the dusts and the maximum explosive concentration was noted. Whether this is true for dust of other types is not known.

The results of the final tests for the oxygen dilutions necessary to prevent explosions are shown in Fig. 3. Dust concentrations correspond to those above for maximum explosibility.

Oat hulls, which developed the least pressure on explosion in air as compared with the other two dusts, were least affected by the introduction of inert gas. For this dust the oxygen content of the atmosphere must be reduced to 13.7 per cent to prevent explosion.

Cork dust, which gave the highest pressure of the three dusts when tested in air, was most affected by oxygen dilution, and its explosion hazard was eliminated when the oxygen concentration had been reduced to 14.1 per cent.

The explosibility of pyrethrum flowers was eliminated when the oxygen content of the atmosphere was reduced to 15.5 per cent. Preliminary tests showed that the explosibility of pyrethrum flowers is influenced by the pollen content. Ground closed flowers, which have a higher pollen content than the open flowers, produced the

greater pressure on explosion and were used exclusively in this work. Since the pollen content varies with the different grades of the flowers, it is recommended that in practice the oxygen content of the atmosphere be reduced to 14.5 per cent. A slight local burning at the source of ignition persisted when the oxygen content was reduced to 13.5 per cent, but the resultant pressure was so small that it could not be measured and there was no propagation of flame.

Increasing the temperature of the source of ignition to 1,200 deg. C. was found to have no effect on the oxygen dilution required to prevent explosion of these dusts.

Inert gases probably have two rôles in preventing dust explosions, namely, the cooling effect which is dependent upon their specific heats and densities, and the reduction of the partial pressure of the oxygen.

Carbon dioxide, nitrogen, and the combination of these two with oxygen, carbon monoxide, and water vapor in the form of flue gas, are practically the only gases that may have industrial application for the prevention of dust explosions.

No attempt was made in these tests to form mixtures of carbon dioxide, nitrogen, and oxygen so that the sum of the carbon dioxide and oxygen would equal 20.9 per

cent of the mixture, which is the quantity of oxygen found in air, for in actual practice the total carbon dioxide, carbon monoxide, and oxygen found in flue gases very seldom equals 20.9 per cent. The variation from 20.9 per cent is evidently owing to the hydrogen and oxygen content of the fuel.

The gas mixtures of air and carbon dioxide of definite oxygen concentration contained more carbon dioxide and less nitrogen than corresponding flue gases having the same oxygen contents. Carbon dioxide has a lower specific heat than nitrogen, but owing to its higher density it has a greater cooling effect per volume than nitrogen. The cooling effect of the gas mixtures, however, is but slightly greater than that of the corresponding flue gases.

The determinations indicated that the oxygen dilutions necessary to prevent explosion of ground cork, ground pyrethrum flowers, and ground oat hulls are 14.1, 15.5, and 13.7 per cent, respectively. Since the constitution of these dusts may vary, which variation, in turn, might affect their explosibility, it is recommended that in the practical application of this method of explosion prevention the oxygen content be 1 per cent less than that given above for the respective dusts to provide a factor of safety and insure complete protection against dust ignitions.

Heat Conductivity of Metals as Factor in Heat Transfer

By Robert Worthington

International Nickel Company, New York

IN DESIGNING kettles, evaporators, condensers, heating coils, and equipment of a like nature it has often been assumed that the heat conductivity of metals is a measure of their capacity for heat transfer. Actually the phrases heat transfer and heat conductivity are applied to two distinct physical characteristics of the flow of heat: heat transfer is the flow of heat by conduction, convection, and radiation from one medium to another, and heat conductivity is the capacity of a single medium to allow heat to flow without convection or radiation. That a confusion of the terms still exists, even among some designing engineers, is due probably to our tendency to require that variables which may enter into an engineering problem be expressed always in numerical terms; since heat transfer rates are seldom reducible to exact quantitative terms, we presumptively apply as substitutes the very definite figures which express heat conductivity. Misapplication of this sort leads frequently to the choice of the wrong material in constructing heat exchange apparatus.

The rate of heat flow, through a tube or kettle wall for instance, is governed by factors other than the heat conductivity of the substance of which the tube or kettle is constructed. Quiescent gas, liquid, or solid films are in almost every case likely to adhere to the surface of the tube or kettle, and experience of both laboratory and practical nature has demonstrated time and again that the larger part of the resistance offered to the flow of heat is due to these adhering films.

Since a number of variables affect the degree in which these films obstruct the flow of heat—variables difficult

in many cases to distinguish and in most cases to express quantitatively,—the conception of films as a part of the heat transfer problem remains a somewhat vague one. In the case of metals, some of these variables which tend to decrease the flow of heat are oxide films, tarnish films, and the accumulation on the surface of the metals of other products of chemical attack, scales of substances deposited by the solutions handled, and metallurgically unclean and rough metal surfaces.

APPLICATION of these principles of heat transmission to practical heating equipment will serve to emphasize the relative unimportance, as a determinant of heating efficiency, of the conductivity of the metal used. In the case of a cooking utensil held over a gas flame, for instance, the resistance to the passage of heat offered by the metal itself is on the order of one-half of one per cent of the resistance offered by the film of water against the inner surface of the container, and the obstructive effect of the gas film on the bottom of the container is greater by many times than that of the water film. It is evident enough that the heat conductivity of the material of which the container is constructed, whether it be copper, aluminum, nickel, iron, Monel metal, or lead, is not an appreciable factor in determining the heating efficiency. Even glass, with a conductivity only one three-hundredth that of copper, was found in condenser experiments to have one-third to one-half the heat transfer efficiency of copper. (Littleton and Bates, *Trans. Am. Inst. Chem. Eng.* 17, 1925, 95).

Certain modifications are necessary in applying these principles to the various types of heating containers and to the different conditions under which they operate. Thus, with the contents of a kettle in a boiling condition the heating efficiency is improved on the order of ten times, since the evolving gas bubbles have both a disruptive effect on the quiescent liquid film and a stirring action on the contents. In case the contents are mechanically stirred, heating efficiency is bettered in pro-

portion to the degree in which the stirring thins down the liquid resistance film. Still another variation exists in the case of heavy-gage walls; although the heavier walls bring the metal into more prominence as a loss factor, it is believed that when two metals differ in heating efficiency the cause will almost invariably will be differences in the physical characteristics of obstructive films rather than in the conductivity of the metals.

IN figuring the efficiency of condenser tubing the conductivity coefficients of the metals are relatively unimportant. Heat is lost by the steam, passes through a quiet film of water which condenses on the outer surface of the tube, through the metal wall, through a quiet water film on the inner wall, and into the cooling water. Investigations have indicated that in an efficiently run condenser the film of condensed water which accumulates on the outer surface of the tube is relatively unimportant as an obstruction to the passage of the heat. To reduce the thickness of the quiescent friction film on the inner surface of the tube, which accounts for most of the resistance to the transfer of heat, the cooling water is passed through at certain velocities, usually from two to four feet per second. In cases where confined space requires greater condenser efficiency velocities up to twelve feet per second are used. Higher speeds are seldom employed inasmuch as the power consumption becomes disproportionately high and rapid corrosion is liable to occur.

In the case of lower speed condensers the flow, of a semi-turbulent nature, is not sufficient to prevent the accumulation of scale, and as a result of the scale, overall heat transfer coefficients decrease with time and sometimes attain low values. The higher speeds are designed not only to prevent scale formation, but also, by virtue of turbulent flow, partially to destroy the liquid friction skin which accounts for lowered heat transfer rates. With these higher velocities the water layer on the outer surface of the tubes tends to become the controlling factor of the rate of heat flow.

ALTHOUGH the heat conductivity of metals is seldom a consideration in the choice of materials of construction for heat exchange apparatus, it is necessary to appreciate that metals differ in the efficiency with which they transmit heat according to their susceptibility to chemical attack and to the physical characteristics of the products of attack. Not infrequently tubes in use for a few hours are found to be functioning only one to ten per cent as efficiently as when first installed. This reflects a resistance film condition. Iron boiler tubes were found in one test to operate more efficiently when coated with an applied carbon composition than when clean. In view of the conception of films and coatings as resistances, this may seem to be a contradiction; actually, however, the presence of the carbon seems to prevent the development on the metal of an even more resistant gas film.

Other examples of the effect of the surface condition of metal on heat transfer rates are common. Orrok (*Trans. Am. Soc. Mech. Eng.* 32, 1910, 1139) determined that corroded Admiralty tubing had a transfer rate only 56 per cent that of clean tubing. McCabe and Robinson (*Ind. & Eng. Chem.* 16, 1924, 478) call attention to the considerable drop in transfer rates with time, in evaporators handling cane juices and salt solutions. Pridgeon and Badger (*Ind. & Eng. Chem.* 16, 1924, 474) found rusted iron evaporator tubes to be only 60 to 75 per cent as efficient as new iron tubes and slightly dirty copper tubes to be only 35 to 50 per cent as efficient

as polished copper tubes; although the conditions were not consistent in obtaining these results, they were sufficiently so to give the figures a roughly comparative value.

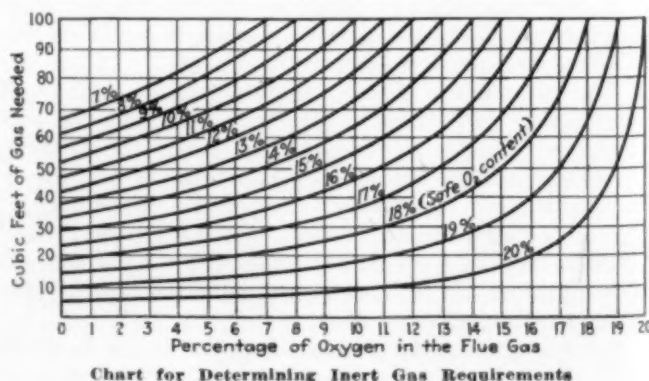
Such metals as nickel and Monel metal are essentially corrosion resistant. It is due to their comparatively strong tendency to remain clean of surface when handling solutions and operating under corrosive conditions that they frequently exhibit greater efficiency as heat exchangers. Furthermore, the range of substances which are economically handled with nickel and Monel metal equipment—acids, alkalis, salt solutions, natural waters, foodstuffs, and organic substances—is probably more diversified than with other types of metal.

Plant for Inert Gas Systems

IN A recent technical bulletin (Number 74, June, 1928) published by the U. S. Department of Agriculture, there are given the conclusions resulting from full scale experimental operation of an inert-gas-protected plant for the grinding of oat hulls. This work, carried out parallel with that described elsewhere in this issue in connection with the elimination of explosion hazards in grinding pyrethrum flowers, cork and oat hulls amplifies the latter and presents a number of useful suggestions for applying such systems to industrial operations.

It was determined that constituents, other than the CO_2 , in the flue gas used for the inert atmosphere, such as might be present when sulphurous or arsenious fuels are used, should usually be removed by gas washing when the material ground was a food product. In some cases, soot was found objectional and required removal by washing. A neutralizing spray or the use of a hydroturbine type of blower with an alkaline liquor instead of water within the hydroturbine, sufficed to neutralize acidity of the gas where the acidity was sufficient to corrode the gas system.

An inert gas system requires a source of gas supply, either in the form of special equipment or in the boiler house. There must be a blower or other means of moving the gas, a distribution system and indicating or recording equipment to show that the gas composition of the system is correct. Once the maximum permissible oxygen content of the system is determined, it is possible to calculate the inert gas requirement when the gas consumption of the system has been discovered. In some cases, manufacturers can supply data as to the normal gas requirements of pneumatic conveying equipment. Frequently the requirements must be determined experimentally. Once this is known, the flue gas which must be added may be determined directly from the chart, using the abscissa scale for the oxygen content of the available flue gas and reading the desired figure from the ordinate corresponding to safe oxygen content.



Engineering Methods Economically Combat Stream Pollution

By *W. L. Sullivan*

Westinghouse Lamp Company, Bloomfield, N. J.

DISPOSAL of acid wastes has only recently become a serious problem to manufacturers in this country. Heretofore, unless its recovery was profitable, all water soluble waste material was eliminated by piping to some convenient river or other natural waterway. Waste was disposed of in this way without cost, and little or no thought was given to the effect of this pollution upon the rivers and adjoining property.

A vivid imagination is not required to visualize the results of several years of unlimited river pollution. Rivers once beautiful became foul-smelling, unsanitary, unsightly streams, no longer suitable for aquatic sports, nor able to support fish life.

The Passaic River was an outstanding illustration of these conditions. Industrial wastage of all kinds was poured into it by the factories along its course. Certain towns emptied sanitary sewage into it. Finally its condition became intolerable and State legislation was enacted to remedy it. Pollution was prohibited and the Passaic Valley Sewerage Commission was appointed with authority to take whatever action was necessary to bring about the regeneration of the lower Passaic River. This Commission built and now maintains a large trunk sewer which takes the bulk of the municipal waste and a large portion of the industrial waste. This relieves the river of a large volume of polluting matter, but there is a large quantity of industrial waste which cannot be carried off in the trunk sewer. It has therefore been necessary for the Sewerage Commission to see that all industrial waste is purified before being emptied into the river. Similar action has been taken or is pending concerning many other rivers.

THE New Jersey law provides absolute prohibition of the discharge of sewage or polluting matter into the river. As a practical proposition, however, this prohibition is so stringent that its strict enforcement would mean the closing of the very manufacturing plants. The Passaic Valley Sewerage Commission have, therefore, taken a broad and practical attitude: they do not insist upon the letter of the law, but have set requirements which can be met commercially and yet are sufficiently high to serve the purpose of the law. The following is the Sewerage Commission's interpretation of what constitutes "polluting matter":

Any material discharged into the Passaic River or tributaries thereto within the Passaic Valley Drainage Area:

1. which is injurious to public health or creates a public or private nuisance.
2. which is injurious to property located along said river or tributaries within said drainage district.
3. which creates odors, gases or fumes due to putrefaction or the presence of chemicals.

4. which substantially discolors the waters, results in the presence of oil or grease on the surface or otherwise renders them objectionable to the sight.

5. which reduces the dissolved oxygen content of the waters so as to interfere with major fish life.

TO OBTAIN an effluent meeting these requirements, many factories have installed elaborate, expensive purifying systems, the efficiencies of which are already apparent in the greatly improved condition of the river. The Passaic Valley Sewerage Commission has fully cooperated with the affected factories and has aided them in the selection of the most efficient purifying plants for the removal of each particular impurity.

The particular phase of water purification dealt with in this paper, is the treatment of the effluent from a bright-dipping room so as to bring it to the standard of purity required by law. The process carried out in this room consists essentially of immersing small brass parts in a mixture of strong nitric and sulphuric acids to obtain the desired color and lustre, washing in running water, coating with a thin film of soap and finally drying in hot sawdust. The brass parts are handled in quantities in perforated or wire mesh baskets, so that the acid drainage is imperfect and a considerable amount of dipping acid is carried into the wash water. The presence of soap has always rendered the effluent turbid, but the volume of soap is small and it was easily eliminated by running it to the sanitary sewer. The acidity, however, was a real problem since it was present in a large volume of water and had to be removed or neutralized before the water could be released from the factory. No alternate process was known which would give the desired finish to the brass parts without the use of acid, so neutralization of the waste acid offered the only solution.

The problem was the selection or design of equipment which would continuously treat a large volume of water, of relatively low acidity, so as to effect its complete neutralization. The flow of water per average working day was from 50,000 to 80,000 gallons and the average acidity, computed as sulphuric acid, was 0.3 per cent by volume. Actually, the acid content consisted of a mixture of sulphuric and nitric acids in the ratio of 6 to 2½ parts by volume, but, for the sake of ease in calculation, was figured as sulphuric acid only. This did not introduce any error in the computation of the amount of reagent necessary to bring about the neutralization.

The volume of water to be treated was so great that it was not practical to construct duplicate sumps or tanks for retaining alternate day's effluents, so that reagent could be added to a whole day's effluent before releasing it to the river. A continuously acting apparatus was,

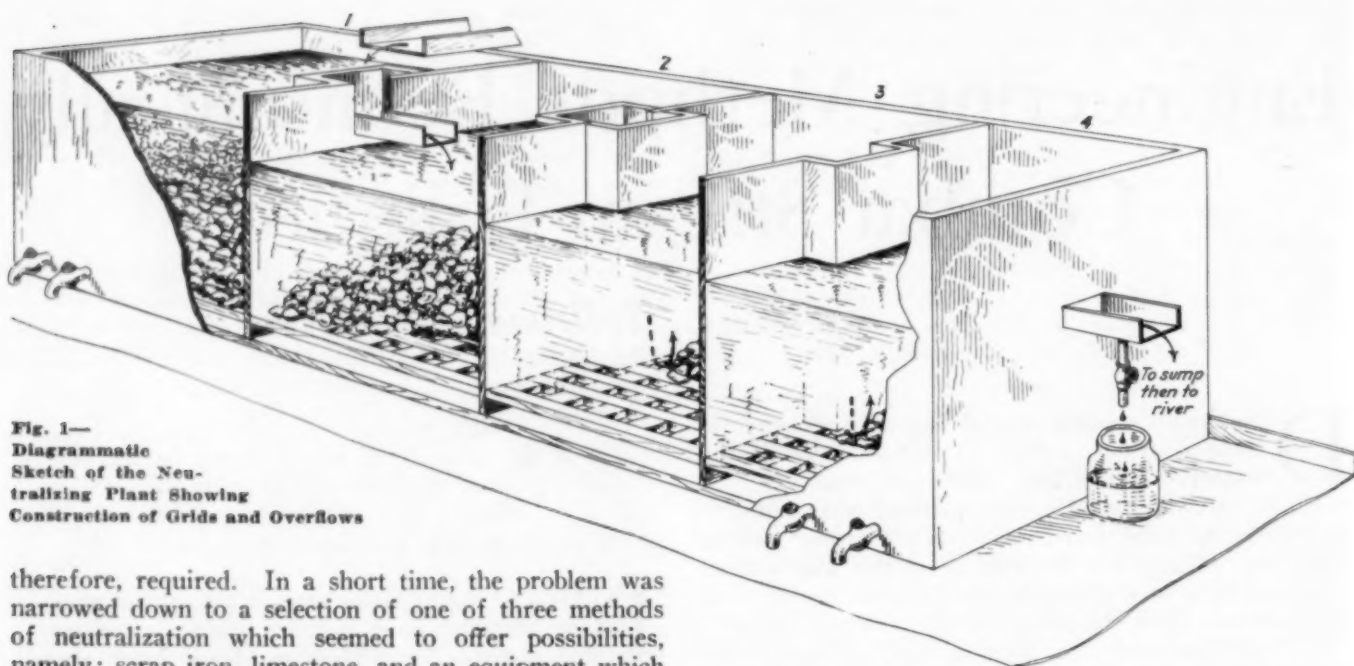


Fig. 1—
Diagrammatic
Sketch of the Neu-
tralizing Plant Showing
Construction of Grids and Overflows

therefore, required. In a short time, the problem was narrowed down to a selection of one of three methods of neutralization which seemed to offer possibilities, namely: scrap iron, limestone, and an equipment which is marketed by a sanitary engineering company for automatically dosing an effluent with lime or soda ash.

USE of the engineering company's equipment entailed a costly installation and more expensive reagents, either lime or soda ash. An excess of the reagents would have to be added in order to insure complete neutralization at all times. This would precipitate salts in the form of a sludge, which would have to be removed in sedimentation tanks. On account of the costly installation and maintenance, this equipment was considered only as a last resort.

Laboratory tests showed that either iron shavings or limestone would neutralize the free acid rapidly enough so that the necessary equipment to treat our continuous flow of water would not be unreasonably large. Methyl orange was used as the indicator, since the Sewerage Commission agreed that the slightly acid reaction due to the presence of salts of a strong acid and a weak base was not objectionable. A temporary equipment in which aliquot parts of the waste water could be continuously treated was then installed, and the main spillway tapped so that a representative sample was continuously delivered to this equipment. Scrap iron was tried first. From a neutralizing standpoint, it was entirely satisfactory, but the effluent was a yellowish-brown in color. This color then was not satisfactory to the Sewerage Commission. Further objection was made that the iron salts would hydrolize and oxidize in the river causing a pronounced discoloration. Experimental work with iron was therefore discontinued and limestone was substituted for it in the temporary equipment.

Operation was continued with limestone for a month. The effluent was found to be clear and colorless, and to contain no free acid to methyl orange. The Sewerage Commission agreed that, if the entire effluent were maintained at the standard of this aliquot portion, it would be entirely satisfactory. Based on our experience with this small outfit, a permanent equipment to treat the entire volume of water was designed and installed and has been operating satisfactorily for almost three years.

The diagrammatic sketch shown in perspective in Fig. 1 illustrates the construction of the neutralizing

plant. It consists essentially of four large tanks through which all acid water must flow before being delivered to the sewer pipe leading to the river. The tanks are made of cypress wood, size 6x6x6 ft., the outlet of each tank being six inches lower than the preceding one in order to provide a gravity flow for the water. The first three tanks are filled with dolomitic limestone and the fourth tank with a special limestone called "glass-house stone." In each tank there is a wooden grating, six inches above the tank bottom, which holds the stone and allows the fine insoluble material to fall through to the bottom, from which place it may be washed out. Each tank is equipped with four city water inlets and four large drain cocks at the bottom so that it may be drained and thoroughly flushed with clean water when necessary. Photographs of the actual installation are shown in Figs. 2 and 3.

The entire plant is set upon acid-proof mastic flooring, surrounded by an eight-inch fillet, which provides a shallow settling tank for sludge, and provided with a drain into a sump in order to quickly eliminate the water when the tanks are drained. The direction of flow through the first two tanks is down through the stones so that if small amounts of soap come through and are precipitated by the calcium salts and float to the top, they may be easily removed by skimming and surface draining. The direction of the flow through the last two tanks is up through the stones. A water connection is provided at the inlet trough, so that the acid water may be diluted sufficiently to insure a maximum sulphuric acid content of 0.3 per cent before flowing through the tanks of limestone. At the inlet and outlet troughs are arranged means of obtaining composite daily samples of the influent and effluent respectively. These samples are taken at a rate of about ten drops per minute and the results of their titration are a guide for maintenance control as well as a permanent record of performance.

THE FIRST commercial operation of this plant brought out certain troublesome features later overcome. One of these was the tendency of soapy water to form a protective coating on the surface of the stones. The soap was, of course, broken down by the free acid and when the resulting fatty acids were mixed with the

calcium salts in the neutralizing tanks, insoluble calcium salts were thrown out and coated the surface of the stone so that it could no longer react with free mineral acids. To eliminate this trouble, soapy water was separated from the acid waste water, and then was piped to the sanitary sewer. The original plan was to have the direction of flow upward through all tanks, but to take care of small amounts of soap which were unavoidably mixed, the direction of flow in the first two tanks was reversed, so that the insoluble calcium salts could float to the surface without coming in contact with the stone. These floating insolubles are easily removed periodically by skimming and surface draining.

Another trouble was caused by the fact that calcium sulphate, a product of the reaction of sulphuric acid with limestone, is relatively insoluble and if the concentrated liquors were allowed to stand in the tanks during the night, an incrustation of calcium sulphide crystallized out upon the surface of the stones, causing caking and rendering the stone inert. This trouble was aggravated by the fact that, due to increased production, the acid content of the waste water greatly exceeded the 0.3 per cent which was found at the time the experimental equipment was operated.

The elimination of this trouble was effected by (1) draining the tanks each night, (2) the substitution of a dolomitic limestone for straight limestone, and (3) dilution of the acid waste with enough water to carry the calcium sulphate formed in solution.

Each night the water is kept running for two hours after operation is discontinued at the source of the acid waste. The soap scum which has collected on the top of the first tank is then removed and the tanks are completely drained. The bottoms of the tanks are thoroughly flushed out using full city water pressure, the stone washed with a flow of water from the top and stirred up with a bar to eliminate any channels which have formed, new stone added to replace that which has dissolved, and the tanks finally filled with clean water. This treatment serves to remove from the bottom of the

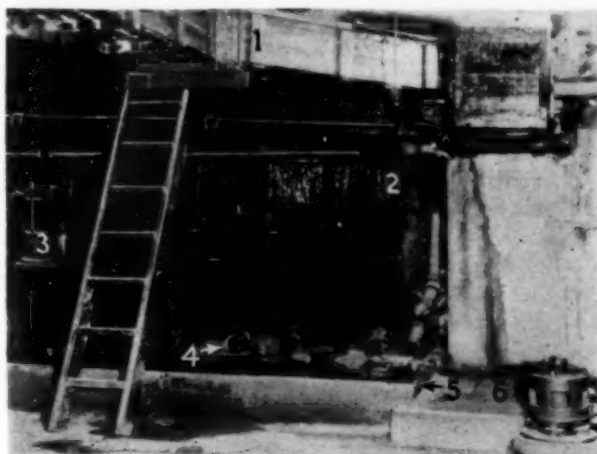


Fig. 2—View of One End of Neutralizing Plant
(1) Inlet trough; (2) Outlet trough; (3) Sampler; (4) Drain cock; (5) Weir; (6) Floor drain sump.

tanks all sludge which would tend to stop them up, and to keep the stone always in good condition with a clean surface exposed to the action of the acid.

The water containing the sludge is drained onto the mastic floor, or shallow settling tank. The drain outlet from this floor is protected with a weir so that a minimum amount of solids is carried in suspension into the sump into which it drains. The solids which are car-

ried in suspension settle to the bottom of this sump, which is really a secondary sedimentation tank. A pump which is automatically controlled by floats empties the water from this sump to another sump which is connected to the storm sewer leading to the river. The settled sludge is removed from the floor to a dump. About once each month it is necessary to remove the accumulated solids from the bottom of the first sump.

Dolomitic limestone, which contains about 40 per cent magnesium carbonate, is slightly slower than ordinary limestone in reaction, but is used in the first three tanks because magnesium sulphate is readily soluble. In the

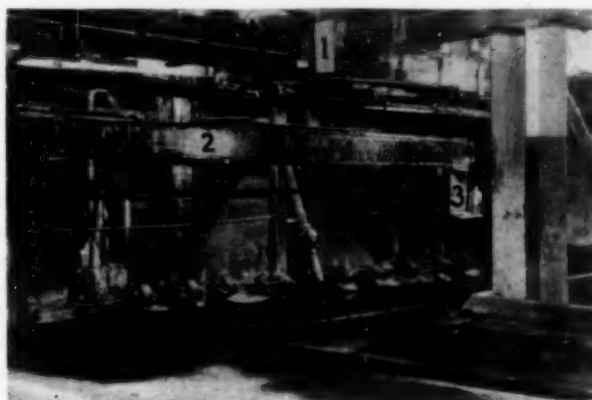


Fig. 3—Another View Showing Settling Floor
(1) Inlet trough; (2) Outlet trough; (3) Sampler.

last tank a very rapidly reacting limestone called "glass-house stone" is used in order to insure complete neutralization. The most satisfactory size of stone for our use was found to be from $\frac{3}{4}$ to $\frac{1}{2}$ inch in the first three tanks and $\frac{1}{2}$ to $\frac{1}{4}$ inch in the last tank.

The use of dolomitic limestone greatly reduced troubles due to incrustations of calcium sulphate, but did not eliminate them when the water treated contained a relatively large percentage of sulphuric acid. It was therefore found necessary to add sufficient water to the influent of the neutralizing plant so that it had a maximum sulphuric acid content of 0.3 per cent which practical experience had shown to be the maximum concentration this plant could handle. This effectively eliminated the trouble. Titration of the daily composite samples of the influent and effluent is very effective for control purposes. The analysis of the influent indicates whether or not the proper amount of water is being added and also whether an excessive amount of acid is being wasted. The presence of free acid to methyl orange in the effluent indicates careless maintenance and serves as a warning that the stone has not been properly washed or that a sufficient amount has not been added.

Since this equipment is located in the cellar, a suction fan was provided to remove the carbon dioxide which is evolved as a reaction product. It has, however, been found to be unnecessary, since the ordinary ventilation does not permit the formation of carbon dioxide pockets.

The installation cost of this equipment was less than one-half the price of the equipment recommended by the sanitary engineering company and the cost of its operation and maintenance is about one-eighth of that estimated for the engineering company's outfit. Its operation has been entirely satisfactory for almost three years. Only upon a few occasions did it fail to deliver an acid-free effluent. These lapses were at once apparent from the daily analysis and were traced to careless maintenance and immediately remedied.

ELECTROCHEMICAL PRODUCTS

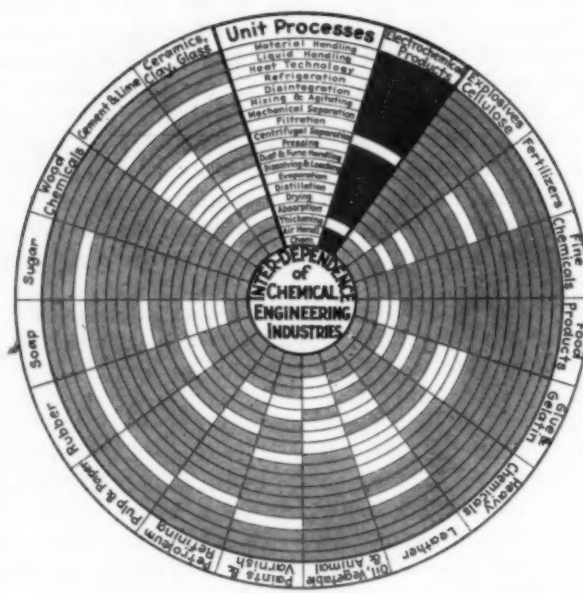
Emphasize Interdependence of Processes and Industries

By C. L. MANTELL

*Consulting Engineer,
Pratt Institute, Brooklyn*

ELECTROCHEMICAL INDUSTRIES may be roughly divided into several classes: those of an electrolytic nature, further subdivided into those of electro-separation type, represented by alkali and chlorine, the electro-winning type, as represented by the copper industries in which the copper is produced by leaching of ore, the large electro-refining group, of which electrolytic copper, zinc and nickel are examples, and the electrodeposition type represented by the electro-plating and electro-forming field; the fused electrolyte group, represented by aluminum, magnesium, and the alkali metals as examples; third, the electrothermal group, examples of which are calcium carbide, cyanamid, graphite and the synthetic abrasives, and last, the products of the electric furnace, which is used as a means of reaching elevated temperatures, such as the ferro-alloys, electric steel and special alloys. Each group and subdivision has problems and applications of the chemical engineering unit processes, but with the emphasis placed differently in the different groups.

WHEN ONE thinks of the electrochemical industries, caustic and chlorine come to mind first. Here one meets a large variety of different electrolytic cells, each one of which has ardent proponents and supporters. It is somewhat difficult to account for this wide diversion of type of cells, but the real criterion as to which of the cells is superior will be the action of a manufacturer when he adds new cells or builds new plants. We then expect to see the most advanced type of cell installed. The chlorine manufacturer is primarily in the chlorine business, and is only secondarily a producer of caustic. It is in the chlorine business and its ramifications, that we find a most amazing interdependence of industry as well as of processes. The recent developments of the synthetic organic chemical industries, as represented by such products as ethylene glycol and related compounds have called for huge production of chlorine in a quantity thought impossible for the future, as a result of the greatly over-extended plants built during the recent war. We thus find plants interdependent as represented by Westvaco Chlorine Products, Inc., at South Charleston, W. Va. (*Chem. & Met.* Vol. 35, p. 158) and plants of the Carbide and Carbon Chemicals Corporation. The first produces material for the organic chemical operations of the second. Hydrogen gas is piped to an adjoining plant where it is consumed. A considerable portion of strong caustic liquor is pumped out of the plant to customers, while chlorine is delivered



to nearby consumers by pumping through pipe lines.

The evaporation of the relatively dilute caustic liquors resulting from the electrolysis of salt, has long been one of the bane of the chlorine and caustic manufacturer's existence. In recent years, however, with the aid of the chemical engineer, high speed forced-circulation evaporators have been developed which have been of considerable aid to the industry. The chlorine manufacturer has finally worked out the problem of disposal of his product in large quantities and partially eliminated some of his evaporation difficulties. After caustic liquor has been evaporated, it must be further concentrated in open pots to produce the fused material of commerce. The caustic manufacturer has learned that by co-operation he can profitably dispose of 50 per cent caustic solution in tank car lots to some of his customers who would ordinarily receive his fused product and have to redissolve it. Of course, there is an economic balance of factors, inasmuch as this constitutes shipment of water. An important and real change in the chlorine industry has been the development of these large tank car shipments of 50 per cent caustic solution. During the last 15 years we have seen the size of containers for liquid chlorine progress from 50 and 100 lb. cylinders, to the one ton container mounted on a tank car in lots of 15 and shipped under a tank car rate, to the development of the present moment in which chlorine is shipped in 60,000-lb. tank cars in the United States and Canada to such customers as can use material in this quantity and demand it as such. There are now 14 such 60,000-lb. tank cars in operation and a number more are being built.

The handling of chlorine in the plant, particularly in its liquefaction, calls for all of the resources of the chem-

ical engineer. Corrosion difficulties are always at hand. Because of the highly competitive nature of the industry, material and liquid handling have been well studied and applied, for they were avenues to cost reduction.

In an effort to make cheaper products and increase profits, the chlorine manufacturer has studied his industry from all angles, particularly from the byproduct viewpoint. Chlorine makers are now utilizing waste hydrogen, all of which, in the Niagara Falls district, goes to synthetic ammonia. Byproduct hydrogen when used for synthetic ammonia brings 50 cents a thousand cu.ft. For every ton of chlorine produced, 9,000 cu.ft. of hydrogen is also made. This brings approximately \$4.50 per ton of chlorine as additional revenue to the chlorine manufacturer. In a number of plants present practice still allows hydrogen waste to go on, inasmuch as the economic utilization of the hydrogen has not been perfected in that locality. It has been stated that eventually all chlorine plants will have synthetic ammonia plants connected up to them.

NO CHLORINE manufacturer in the United States is at the same time producing hydrochloric acid. The chlorine industry is one of heavy investment cost, an expenditure of approximately \$50,000 per ton of daily chlorine capacity being necessary for the plant alone, exclusive of working capital. With the sterner application of economics and chemical engineering processes has come the almost entire departure of bleaching powder from the chlorine manufacturer's field. Aluminum chloride, a material made through the use of liquid chlorine, is becoming of some importance in carbonizing wool in the textile industry. One Canadian chlorine producer is a manufacturer of table salt as a byproduct of the electrolysis of sodium chloride. The chlorine industry is responsible for about 21 per cent of the caustic production of the United States. This amounts approximately to 100,000 tons per year. The price for caustic, however, is determined entirely by those who produce the material by the lime chemical process. One manufacturer is experimentally producing hydrochloric acid from chlorine directly, but the project is thus far only experimental.

ANOTHER interdependence of industries is represented by the use of chlorine to reclaim tin plate scrap, thus making material which formerly could not be fed into steel furnaces available for such use as steel scrap, and producing at the same time stannic chloride, a material required by the silk industry for weighting. The electrochemical method for the manufacture of chlorine is now the only commercial one, being decidedly more economic than the straight chemical methods, which have long since been made obsolescent. The comparison of the chemical and the electrochemical methods is one on a dollar and cents basis.

In the case of those materials produced from fused electrolytes, in many cases the comparison on an economic basis between the electrochemical and the chemical method does not enter, for the electrochemical one is the only one available for the production of these particular materials. The vast aluminum industry of the United States requires the services of the chemical engineer from one end to the other, from the production of "ore" of sufficient purity from bauxite, the manufacture of electrodes, the reduction of the alumina to the finished metal, and the alloys of the metal in the production of commercial products. Present methods for the produc-

tion of purified alumina are almost exclusively chemical in operation, but it is expected that shortly an electrochemical competitor may dominate the field. Recent developments have emphasized the importance of studying the chemical engineering industries from the process viewpoint alone. The application of continuous counter-current decantation systems for the production of alumina has replaced processes of filtration. Material handling by pneumatic systems has been applied. Studies of agitation have shown in some plants that a shortening of the agitation period, followed by idle times, improved practice and resulted in marked savings in power. Borrowing and adapting of equipment from other industries, such as Pachuca tanks from the metallurgical field, has been of considerable aid. In the manufacture of electrodes for use in aluminum production, and in electric furnaces there has been intensive study of heat technology. Disintegration of materials, such as petroleum coke, tars and pitches have brought along their own problems. Large quantities of materials and products must be handled and transported. Dust and fume handling is evidenced by the application of grinding mills with air separators, dust collectors and pneumatic systems connected with them. Extrusion, as an example of pressing, is quite familiar in electrode manufacture, as well as molding and shaping. In anode making, heat transfer is brought to a very high point in regenerative furnaces, operating at very high thermal efficiencies.

THE FUSED ELECTROLYTE industries are located at power centers, as the industry must have cheap power for its continuous existence. This cheap power ranges, however, from 3 mills per kw.-hr. to the newest installation of 1 mill per kw.-hr.

The preparation of aluminum and the other metals from fused electrolytes is ordinarily conducted below 1,000 deg. C. Another class of electrochemical industries are those which are commonly termed electro-thermal, represented by graphite, calcium carbide and the synthetic abrasives, such as silicon carbide and fused alumina. The same methods and processes which produced aluminum "ore" for aluminum, yield the raw materials for fused alumina. The production of these materials is one in which heat technology is emphasized, inasmuch as they are all produced at elevated temperatures. Good furnace design is essential for continued commercial success. It is interesting to note that the synthetic abrasives in modified structural forms are also some of our best refractories, having unusual properties and applications. Their preparation is the combined work of the chemical engineer and the chemist. Often the producer of electrochemical products must seek within his own industries for suitable materials of construction for his needs and severe conditions. Material handling, because of the tonnage quantities involved, requires serious consideration as to the best possible methods. Refractories present a problem and cause continued searches for better and better material.

IT IS TO BE NOTED that the manufacturer of graphite finds it cheaper to first employ coal or gas to bake his electrodes from their raw molded state to as high a temperature as possible with such means, and then continue the heating to graphitization by the use of the electric current. In other words, he avoids the use of electric current, despite the fact that he can obtain it at a relatively cheap rate at hydro-electric power centers, but finds that even that cheap rate is not sufficient to allow

him to use it in competition with coal which has to be transported from the mines. This is an economic application with a vengeance.

The production of calcium carbide brings us again to an interdependence of industries, for it is now the raw material for the synthetic manufacture of organic materials such as acetic acid, acetaldehyde and acetone. Of course, calcium carbide is the basis of acetylene, now of increasing importance due to the greater expansion of welding in the production of equipment, buildings and structures. The story of the application of synthetic abrasives made of silicon carbide and fused alumina is one which is well known. These synthetic products, the result of the labors of the chemical engineer, have displaced the natural abrasives because they are far superior. New uses and new applications are being found because of their superior quality. Grinding, screening and grading of the abrasives so that they may be made more suitable for specialized work are chemical engineering process problems.

The statement is often made and found in the literature that the greater proportion of the carbon disulphide production of the United States is made in electric furnaces. Such is not the case, inasmuch as in many cases and localities the chemical thermal manner of production is the cheaper one. As a matter of fact only a small percentage of the carbon disulphide production of the country is made in electric furnaces.

THE ELECTROTHERMAL, or electric furnace, method for making phosphorus involves a somewhat unique application of the chemical engineering unit processes of dust and fume handling, inasmuch as Cottrell apparatus for electrostatic precipitation is used in the production of phosphoric acid as a means of collecting the acid. This ties in with the production of all the various types and varieties of phosphates of sodium, calcium and other metals in different degrees of acidity.

Heat technology is further emphasized in electric furnaces, which are ordinarily included in the electrochemical industries. The production of ferro-alloys and related alloys has brought along a high temperature metallurgy and technology in which the usual chemical engineering unit processes are lost sight of because they are subordinated. But here again, as in all the other electrochemical industries, we find disintegration, mechanical separation and dust and fume handling. Materials of construction must always be considered, and the search for constant improvement is continually going on. At the present day, the greater quantity of our so-called "crucible" steel is made in electric furnaces, and not in crucibles. We owe to the electrochemical industry many of our most valuable materials of construction, among them being the stainless steels and irons.

Electro-winning is a portion of the chemical engineering industries in the electrochemical field with which the chemist is little familiar. Reference is made to those so-called "metallurgical" methods as exemplified in the winning of copper from its ores by leaching methods, followed by electrolytic precipitation of the metal. The whole procedure, processes and operation involve the unit process of chemical engineering on a huge scale. Disintegration is represented by grinders which can consume copper ore at a rate faster than carloads can be dumped into them. Counter-current leaching methods have been the salvation for the production of high yields of copper from the ores running as low as 1½ per cent of the metal. The development of the insoluble anodes, operating effi-

ciently resulted in lessening of production cost. This was the work of chemical engineers. An analogous situation exists in the hydro-metallurgy of zinc, and to a very much smaller extent of iron, in the preparation of electrolytic metal. True it is that in this particular field the metallurgist and the chemical engineer are workers in a common cause, with decidedly the same interests and practically the same viewpoint. By the application of chemical engineering methods on a huge scale, operators working ores as low as 1½ per cent of copper can produce the metal and put it on the market at less cost than other operators working on ores running 60 and 80 per cent of the metal; this latter material must be smelted at a higher cost than is met in the huge scale methods of the low-copper-content-ore user. It is often stated that the chemical engineer is only beginning to apply many of the material-handling methods which he is adopting from what he has learned from the miner and the metallurgical engineer. True enough, but he is learning rapidly and applying his knowledge in his own and related industries.

IN THE electroseparation group of the electrochemical industries, unit process emphasis is on materials of construction, evaporation, liquid and gas handling; in the electro-winning group on material handling, disintegration, leaching and dissolving; in the fused electrolyte group on grinding, material handling, mechanical separation, pressing and heat technology; in the electrothermal group, on materials of construction, power application and heat technology to such an extent that the other unit processes are almost completely subordinated; the same holds true for the electric furnace group; in electro-refining we find principally evaporation, crystallization and drying, but liquid handling and materials of construction are important; and in electroplating, future progress in large scale production of plated surfaces and protective coatings will hinge largely on the application of the unit processes of chemical engineering. Technology has completely pervaded the electrochemical industries, although as a whole they are as yet young.

ONE OF the largest, in point of tonnage, of the electrochemical industries is the electrolytic refining of metals. Here is one of the few places in the field where we find processes such as evaporation, crystallization and drying. Chemical methods are largely in evidence in the working up of byproducts such as nickel salts, selenium and tellurium. Liquid handling in the electrolytic circulating systems, corrosion resistant materials of construction, and low temperature operations are everywhere. The electrochemical methods have no competitors in producing metals of necessary qualities.

Last but not least, if we look forward to the future, is the group of electrochemical industries concerning themselves with the preparation of metallic coatings such as nickel, zinc, copper, cadmium, chromium and a host of others, and non-metallic coatings such as rubber. Many of these coatings are decorative, combination layers of some are protective, and when properly applied, layers of some of the metals are unusually corrosion- and heat-resistant. They add to our available and needed materials of construction. Usually this group of the electrochemical industries is subordinated to the industrial machine manufacturing operations with which they are interconnected. The development of continuous plating, through especially adapted material handling methods and progress in technology from chemical engineering study, has brought great strides.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Drying Efficiency in Recovery of Sulphur

To the Editor of Chem. & Met.:

Sir—I have just read with interest an article by Mr. K. N. Cundall, in the July, 1928, issue of your magazine, entitled "Drying Sulphur Recovered from Manufactured Gas." In that article there appears a statement which I believe should be corrected, because it may tend to give an erroneous idea of efficiency of certain types of drying equipment. The portion of the article to which I refer is on page 409, second paragraph, starting with "The dryer was 20 feet wide" and ending with "—was found to be 0.204 pounds."

It so happens that I did some work with the Pacific Gas and Electric Company, looking toward the solution of their drying problems, and have in my possession a summary of all the tests and determinations made by that company, which form the basis for Mr. Cundall's article, so that I am in a position to check the figures.

The statement is made that the tunnel dryer has an efficiency of 88 per cent. This figure is so far above any I have found in a long experience that I felt it should be challenged. On investigation, I find that the figure was arrived at through a calculation which was erroneous. The company's summary of the tests takes a figure which represents the sensible heat in the air leaving the dryer and adds to it the heat in the water evaporated. This sum is then divided by the heat in steam, which gives a number of pounds of steam. This latter figure when divided by the actual condensation of steam gives what purports to be 88 per cent efficiency. Of course, on the face of it, this calculation is incorrect, inasmuch as the heat in the air leaving the dryer is a *loss* and should not, of course, be added to the work of evaporation, which is *useful* work. It is, of course, well known that efficiency means the ratio of actual useful work done to the actual heat input.

In order to arrive at the correct efficiency of the dryer, I have taken, from other portions of the company's summary of tests, data on the actual work done. This is the sum of the heat required to raise the dry substance from the entering temperature to the leaving temperature, the heat required to raise the water contained in the material from the entering temperature to the leaving temperature, and the heat required to evaporate the water. This sum, divided by the heat equivalent of the actual condensation of steam in the dryer, gives an actual thermal efficiency of the dryer of 40 per cent. This figure is reasonable for this type of machine, even though this particular apparatus has been given the benefit of every doubt.

I would appreciate it if you would publish this letter in order that none of your readers may have an erroneous impression of the efficiency of the type of dryer mentioned.

A. W. LISSAUER.

President,
Louisville Drying Machinery Company, Inc.

Correct Efficiency Should Be 41.7 Per Cent

To the Editor of Chem. & Met.:

Sir—In the article on "Drying Sulphur Recovered from Manufactured Gas," published in the July issue of *Chemical and Metallurgical Engineering*, I gave a figure in an efficiency calculation which might be misinterpreted.

The figure in question is on page 409, near the end of the third paragraph, the sentence reading: "Actual steam consumption was found to be about 1978 lb. per hour, giving a dryer efficiency of 88 per cent. This figure for efficiency should be 41.7 per cent. We had been including the sensible heat lost up the stack with the air as part of the efficiency in order to obtain the radiation loss to compare with some previous figures. Of course, strict engineering practice, however, is to give the efficiency as the ratio of energy used in evaporating the water and raising the temperature of the material to the energy input in the steam, hence the correction of the efficiency given to 41.7 per cent."

K. N. CUNDALL.

Pacific Gas & Electric Company,
San Francisco, Calif.

* * * *

Can You "Do It Better With Gas"?

To the Editor of Chem. & Met.:

Sir—May I have the privilege of bringing an unusual problem to the attention of your readers? The public authorities of the City of Bombay are considering the improvement of the time-honored method of the disposal of Hindoo dead (i.e., burning the bodies on wood fires) and they are inclined to favor gas-fired incinerators. My clients, who operate the electric supply service of the city, have asked me whether or not any counter electric proposition can be put forward?

I see that there is a U. S. patent No. 989,960 (Giddings) for a resistance furnace for the purpose. But I am unable to find out whether it has ever been put into practice.

A number of electric furnace makers and users read your journal, and if any of them have dealt with the crematorium problem I should be very grateful if they would communicate with the writer of this letter.

A. T. COOPER,
Consulting Engineer.

8 Stone Buildings,
Lincoln's Inn,
London, W. C. 2, England.

* * * *

EDITOR'S NOTE. Since receipt of Mr. Cooper's interesting inquiry on electric crematoria, we learn that the British Resistor Company, Ltd., a branch of the Global Corporation, has submitted a proposition along the lines of an existing electric crematorium at Mountain Spring Valley.

CHEMICAL ENGINEER'S BOOKSHELF

Heating by Electricity

ELECTRIC HEATING. By *Edgar A. Wilcox*. McGraw-Hill Book Company, New York. 469 pages. Price, \$5.

Reviewed by C. L. MANTELL

WIDELY spreading interest in electric heating and its constantly increasing diversity of application make the appearance of this authoritative work quite timely. The book undertakes to show that the merits of electric heating are now being accorded deserved recognition. Its context is full of suggestions for new uses.

For a field so broad the volume is remarkably complete, the data in tables always pertinent, concise and accurate in an engineering sense. Errors are surprisingly few and in all cases of a minor nature.

The author devotes the first section of the book to thermal and electrical fundamentals, including a detailed chapter on resistor elements and heating units. Applications to cooking, water and air heating, ovens and furnaces, high temperature applications in iron, steel, brass and high frequency work, pot furnaces are specifically treated. Welding, both arc and resistance, is classified as electrical heating. Sterilizers, stills and steam boilers are given a chapter as they deserve; incubators and brooders are also given attention.

The author gives his book the range of a "handbook" on the subject, for useful data on temperature measurement, thermal insulation, specific heat, etc., are included.

The engineering and economic side of the field is emphasized. The book should be very useful to those engaged in creating markets for either heating apparatus or the resultant heating loads, and to engineers in the chemical engineering processes field who are willing to be bitten by the suggestion bug.

* * * *

Gas Company Practice

MANUFACTURED GAS. A Textbook of American Practice, Volume II: Distribution, Utilization and Some Business Aspects. By *Jerome J. Morgan*. Published by the author, Broadway at 119th Street, New York City. 447 pages. Price, \$7.50.

Reviewed by R. S. McBRIDE

AMERICAN gas company practice has never been adequately described in a book available for either classroom or general professional use. Hence this second volume by Morgan should be as welcome as was the first. The presentation is very comprehensive, and in general with excellent selection of both text and illustrative material. The main regret which any reader will have is the inadequacy of the book to give many frequently wanted details; but this is the inevitable effect of covering in a single volume the whole field of distribution, utilization, and business aspects of the public-utility gas company.

As a companion to the first volume on manufactured gas, this work has been prepared by the same special photostat process from typewritten text. However, the illustrations are clearly presented and the text is not unduly difficult to read. The subject matter is presented in a very readable style; in fact anyone perusing the work finds at numerous points that easy informality

which is a natural result of reducing a series of lectures to book form within a short period. This contributes much more to ease of reading than it detracts in other respects from the work. Hence, one who intends to make much use of the volume will hope that an early revision, which is promised by the author in his Afterword, will not modify this feature. The same reader will, however, probably hope that the next edition will appear in type rather than as a photostat, because such modification of the mechanics of presentation would assuredly make for the reader's comfort.

The chapter headings, which give an excellent idea of the comprehensive nature of the volume, are: Storage of gas; mains and services; compressors and governors; meters; distribution design; new business department; domestic appliances; general industrial applications; gas furnace design; selection of an industrial fuel; testing and research department; safety, accident prevention and first aid; accounting and statistics; principles of rate making; and public relations.

* * * *

Advances in Photochemistry

PHOTOCHEMICAL PROCESSES. By *George B. Kistiakowsky*. American Chemical Society Monograph Series, Chemical Catalog Company, New York. 270 pages. Price, \$5.50.

Reviewed by J. H. MATHEWS

PHOTOCHEMISTRY has for many decades been an attractive field for investigators who have been interested in the mechanism of reactions. Until a few years ago, however, most of the investigations were of a qualitative nature and consequently many of them have but little real value. In recent years, however, improved experimental technique has been employed and remarkable advances are being made. Until exact quantitative methods were available little of any real value could be accomplished in the study of photochemical kinetics, and inasmuch as the difficulties in the development of satisfactory quantitative methods were greater here than in any other phase of chemistry, it is not surprising that the chief development in this field has been so recent. During the past decade or two there has been a veritable flood of experimentation and theoretical conjecture in this most interesting and important field. Because of this extremely rapid development it has been very difficult to keep pace with all that has been accomplished.

Previous to the publication of Kistiakowsky's most remarkable book on photochemical processes, no one has had the patience to assemble the mass of material now available and to subject it to a critical discussion. This author has performed an extraordinarily valuable service in collecting this widely scattered material and presenting it in a comprehensive and most interesting manner. The arrangement and treatment of material is excellent, and the review is remarkably complete. To workers in this field this book will be considered an absolute necessity, and it should be in the library of every person who considers himself a physical chemist.

The monograph is, of course, not a text, but nevertheless it will be of great value to graduate students who

are taking courses in photochemistry and to others who are anxious to keep up with the more modern developments. The monograph would make an excellent reference book for a seminary course in this field.

The book is replete with references to the original literature and is excellently indexed. It consists of six chapters with titles as follows: The concept of light quanta and photochemical kinetics; the equivalence law; chain reactions; photosensitization; catalysis and inhibition; frequency of radiation, temperature and the rate of photochemical reactions. The typographical work is good, and very few errors have been noticed. It is very regrettable that the price of \$5.50 per copy has been established: it would seem to the writer that the importance of this work is such as to forecast a sale which would justify a lower price.

* * * *

The Fats and Waxes

THE INDUSTRIAL CHEMISTRY OF THE FATS AND WAXES. By T. P. Hilditch. D. Van Nostrand Company, New York. 1927. 460 pages. Price, \$6.

FATS and waxes, perhaps more than any other group of chemical products, have been subject to improved rather than revised modern technologic methods. Being produced in a fair abundance the world over, and in part as byproducts of other vital industries, their availability is independent of fixed resources and little provocation is hence offered for any fundamental changes in production.

The author has confined himself to the essentials that touch upon the wide and varied field of the waxes and fats. A sacrifice of small detail, however, has enabled him to encompass within one volume material that would otherwise really have necessitated a small "handbook." Fats in particular, represent an enormous number of constituents and combinations; moreover, their range of application covers direct and supplementary edible products, various soaps, illuminants (candle consumption, incidentally is above the pre-war figure), glycerine, paints and varnishes, dye intermediates, linoleum, and specialized types of lubricants. The outstanding "innovation" in the fat industry, hydrogenation, is comprehensively treated in a separate chapter. In discussing these various aspects, then, in addition to the questions of composition, occurrence, and industrial methods of production, the author has obtained a certain very desirable inclusiveness through his comparative brevity.

* * * *

Homogeneous Organic Reactions

THE MECHANISM OF HOMOGENEOUS ORGANIC REACTIONS. By Francis Owen Rice. The Chemical Catalog Company, New York. 211 pages. Price, \$5.

Reviewed by J. E. BOOGE

THIS A.C.S. monograph of 211 pages attempts to co-ordinate the attacks upon homogeneous organic reactions from the physical chemical viewpoint. Naturally only a minor portion of the organic literature is covered, namely, that in which the data are so presented as to yield to physical chemical interpretation. Still, the field is tremendous and it is cause for congratulation that one author can cover it all. Discussion of many types of reactions is necessarily brief but ample foot notes refer the interested reader to the original literature,—a valuable feature of the A.C.S. series.

Chapter I serves as an introduction. It states that there is no mechanism of homogeneous reactions upon

which chemists are agreed. The author favors a mechanism dependent upon the presence of dry (non-hydrated) hydrogen or hydroxyl ion in low concentration. The reaction rate then varies with the rate of collision of this catalyst with "various solvated or unsolvated forms of the reactants," including intermediate addition compounds.

Measurement of reaction velocity is briefly discussed in Chapter II. Chapter III deals with the rather extensive experimental evidence of addition compound formation in organic systems. Chapter IV is an able theoretical discussion of possible mechanisms of reactions, including the radiation hypothesis and the (collision) activated molecule hypothesis as well as the author's dry hydrogen ion theory. In the later chapters there are clear discussions of isomeric changes, hydrolytic reactions, the reactions of aliphatic hydrocarbons, aromatic compounds, general reactions and a few special topics. The author's critical opinion of hydrolytic reactions is missed in certain other chapters.

This monograph should prove extremely useful in directing attention to this fertile field where "even with the few tools now available a great many of the problems confronting us may be wholly or partly cleared up."

* * * *

German Gas Technology

TECHNISCHE GASE. By Franz Muhlert and Kurt Drews. S. Hirzel, Leipzig, 1928. 416 pages. Price, 24M.

Reviewed by E. R. WEAVER

IF EXISTING technical knowledge on the production and use of gases is to be condensed into a volume of 416 pages, the treatment of each subdivision of the subject is necessarily very brief. Within this book are treated subjects so diverse as the generation of ozone, the fixation of atmospheric nitrogen, the gasification of peat, the properties of gas coals, details of construction of the great variety of carbonizing plants and gas producers, the liquefaction, fractionation, purification, distribution and measurement of gases, gas analysis, calorimetry, refrigeration, domestic heating appliances and industrial furnaces, power production, and the importance of gases as fuels. The authors have put into the one volume a surprising amount of information upon so many subjects.

The most attractive feature of the book is its 196 unusually well drawn and beautifully printed illustrations. The subject matter seems to constitute a fairly comprehensive manual of European practice; American practice is almost completely ignored. The book is volume nine of the series entitled "Chemie und Technik der Gegenwart" and, appropriately, the historical material which usually encumbers a technical summary, particularly a German one, is largely absent. So, also, is the review of endless patents, of possible but not proven merit, which is common to many books of this type.

* * * *

Preventing Patent Predicaments

ROBB'S PATENT ESSENTIALS. Revised Edition. By John F. Robb. Funk & Wagnalls Company, New York. 1928. 485 pages. Price, \$5.

Reviewed by ROSWELL F. HATCH

THIS is a new edition of an earlier publication by John F. Robb, which appeared some five years ago. This book does not pretend to be a technical work for patent attorneys, although it might be useful under some

circumstances. It is intended more particularly to give executives, engineers, and inventors a general understanding of patents and the process followed in the Patent Office in the grant of patents.

Its size alone indicates that it goes into details of the patent business more extensively than is usual in works intended particularly for laymen. There is a great amount of useful information to be gained by a careful reading of the book, but it is doubtful that many readers will take the time and thought necessary to obtain full value from it.

All in all, the book comprises nineteen chapters. The first five chapters give a very good idea of the preparation of patent applications, the fourth comprising five excellent articles written by examiners in the Patent Office. A study of Chapter 6 should enable an inventor or engineer to criticize his attorney's claims, when that is necessary. The chapter devoted to assignments and contracts is one which should be of particular value to the average reader. A general knowledge of this subject matter would do a great deal toward reducing patent litigation. Four chapters are devoted to typical specimens of various forms of patent applications, showing the manner in which the applications are prosecuted before the Patent Office.

The reader starting to look at this book should be prepared to do so carefully, and not to skim it through without reading the entire context. It would be dangerous, for example, if an inventor were to read the citations on pages 19 and 20 without reading the statement following on page 21. If he did so, he might get the idea that the grant of a patent assures the patentee of immunity from infringement, which is not the case, as clearly stated on page 21. There are also occasional statements in this work which might mislead inexperienced readers. Page 144 states that "all claims of an application must read upon some single figure of the drawings." This is highly desirable, where possible, but on complicated inventions it can seldom be done.

The class of men for whom this book is particularly intended would be greatly benefited by reading it thoroughly, and it is to be regretted that comparatively few of them will take the time or trouble to do so. On the other hand, the book is hardly extensive enough for the use of attorneys engaged in the regular business of soliciting patents.

ELEMENTARY ORGANIC CHEMISTRY. By Homer Adkins and S. M. McElvain. McGraw-Hill Book Company, New York. 1928. 183 pages. Price, \$2.25.

Reviewed by C. S. MARVEL

THIS BOOK has been written to furnish a text for a short course in organic chemistry of approximately fifty class periods which is given at the University of Wisconsin. The authors have presented the fundamentals with brief mention of some of the applications of organic chemistry, as they "prefer to have the skeleton of the course in the text-book and attempt to vitalize the subject matter in the classroom rather than to boil down and extract the essential ideas from a more comprehensive book."

In the first chapter the student is introduced to all of the common functional groups and many of their reactions in the discussion of the derivatives of methane and ethane. Then the various classes of aliphatic compounds with a single functional group are described in order. The discussion of the aromatic compounds follows at this place and the benzene ring is treated as

a new functional group with characteristic reactions. Finally the aliphatic compounds with more than one functional group are discussed. In connection with these compounds the ideas of optical isomerism, geometric isomerism and tautomerism as well as the chemical nature of the natural products such as carbohydrates and proteins are considered.

The book makes a good appearance and contains comparatively few typographical errors. It should prove to be a useful text for other short courses in organic chemistry.

* * * *

LABORATORY GLASS BLOWING. By Francis C. Frary, Cyril S. Taylor, and Junius D. Edwards. Second edition. (Formerly entitled Laboratory Manual of Glass Blowing). McGraw-Hill Book Company, Inc., New York. 116 pages. Price, \$1.50.

IN THE fourteen years that have elapsed since Dr. Frary published the first edition of this practical little book, a steady demand for it has necessitated two reprintings. In that time also, Pyrex glass has added a new technique to the art of glass blowing. Hence, the revised edition, in which the original author has collaborated with two of his associates in the Aluminum Company of America, will be welcomed as an old friend by all those who have occasion to work with glass. The book provides a clear and detailed discussion of the elements of glass working. It should prove valuable to the expert glass blower for the numerous "tips" it contains and invaluable to men in physical and chemical laboratories who, though unskilled in the technique, wish to repair or modify their own glass apparatus.

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COMMERCE YEARBOOK, 1928. VOL. 1, UNITED STATES. Compiled by the Bureau of Domestic and Foreign Commerce, Washington, D. C. U. S. Government Printing Office, Washington. Price, \$1.25.

In this newly completed issue of the Commerce Yearbook are incorporated reviews of conditions in 1927 and statistical information originally collected by numerous government bureaus, trade associations, and journals. Production, price trends, trade, and finance are some of the topics which are reviewed and summarized.

* * *

STANDARDS YEARBOOK 1928. Compiled by The National Bureau of Standards, and issued as Bureau of Standards Miscellaneous Publication No. 83; available only from Government Printing Office, Washington, D. C. 399 pages. Price, \$1.

This is the second of the series Standards Yearbooks which represent the greatly enlarged report of the Bureau. The volume is a complete resumé of both national and important international standardizing activities, including many in which other than official agencies are sponsors. Industrial research laboratories should have the volume in their library, and many industrial executives and sales departments also require it because of the reference to new industrial developments in technology and trade standards.

* * *

MINERAL RESOURCES OF THE UNITED STATES 1925. Compiled and published by the United States Bureau of Mines. Part I—Metals. 768 pages. Price, \$1.25 per copy, cloth bound. Part II—Non-metals. 615 pages. Price, \$1 per copy, cloth bound; available only from Government Printing Office, Washington, D. C.

Another of the well-known Mineral Resources series. It includes in the two bound volumes all of the chapters which have been issued separately on various metallic and non-metallic products investigated statistically each year by the Bureau of Mines.

Selections from Recent Literature

THERMAL INSULATION. I. S. Cammerer. *Chemische Fabrik* 1928, 319-20, 341-2. Applications of thermal insulating materials in industry for conservation of heat or cold; testing and evaluation insulating materials and insulated pipes and the like.

AVIATION ALLOYS. P. Schwerber. *Röhrenindustrie* 21, 223-5 (1928). A description of Al alloys useful for making pipes and tubing used in aircraft, and of methods for commercial production of these alloys.

SAMPLER. J. von Meerscheidt-Hüllessem. *Chemische Fabrik* 1928, 357-8. Illustrated description of a device to facilitate sampling loose material or powders by the quartering method, comprising a funnel in quartered pyramid shape and a container with 4 compartments.

STARCH. O. K. A. Krizkovsky. *Chemiker-Zeitung* 52, 424-5, 466-7, 486-7 (1928). A detailed description of the methods and equipment used in manufacture of starch from corn, with discussion of the recovery and utilization of by-products such as maize oil.

NITRATES. F. Chemnitius. *Chemiker-Zeitung* 52, 465-6 (1928). Description of two processes for making Ba nitrate from the carbonate, with 99 per cent yield, in a plant producing 40,000 kg. per month; and a method for making Sr nitrate from the hydroxide, with 98 per cent yield and 30,000 kg. monthly output.

UNIMETER. L. Bloch and H. G. Frühling. *Chemiker-Zeitung* 52, 488-9 (1928). Illustrated description of a new instrument, especially designed for works laboratory use, which is applicable for all tests of transparent or opaque materials involving measurement of color or intensity of ordinary or polarized light. Uses as photometer and as colorimeter are described.

DRY CLEANING. A. E. Hatfield and E. A. Alliot. *Journal of the Society of Dyers and Colourists* 44, 171-7 (1928). Factors involved in dry cleaning are set forth, as basis for an account of a newly developed method giving improved results with greater economy in dry cleaning. The method is considered applicable in laundering also.

DYEING. H. R. Hirst. *Journal of the Society of Dyers & Colourists* 44, 163-70 (1928). Unevenness in dyeing may be caused by uneven distribution due to extreme affinity of dye for fiber, or by local variations in fabric properties, or by faulty manipulation. Precautions for obtaining even dyeings on wool and fabrics containing wool are described.

EVAPORATION. Ernst Jantzen and H. Lindemann. *Chemische Fabrik* 1928, 373-5. Description of an apparatus in which about 40 liters of water per hour can be evaporated at 15 deg. C., or proportionately smaller amounts at lower temperatures.

CUPROUS OXIDE. E. Abel and O. Redlich. *Zeitschrift für Elektrochemie* 34, 323-6 (1929). Description of a method and apparatus for electrochemical production of cuprous oxide in a solution of faintly alkaline NaCl, with electrolytic Cu electrodes.

DYEING COTTON. A. Jackson. *Dyer and Calico Printer*, July 8, p. 17; July 15, p. 29. Processes of application of the alizarin dyes to cotton yarns, fabrics and piece goods are reviewed. Directions are given for preparing the goods and for dyeing by the chrome mordant, sumac-chrome mordant and one-bath methods.

MINIUM. J. H. Frydlander. *Revue des Produits Chimiques*, June 30, pp. 441-5. The useful properties of minium, especially as a pigment, have been greatly enhanced by the "super-dispersion" method of producing it in extremely fine sub-division. The process depends on obtaining PbO in finely divided form by condensation of its vapor, and oxidizing without fusion so that the resulting minium is equally fine.

CHEMICAL PLANT. S. J. Tungay. *Chemical Age*, July 14, pp. 27-30. The properties of "chemical lead," as related to its use for acid resisting chemical equipment, are reviewed. Some observers have found that a trace of Cu improves the acid resistance. Properties and uses of hard (antimonial) lead and regulus metal are also considered.

AUSTRALIAN LIGNITE. David Brownlie. *Industrial Chemist*, July, pp. 284-6. Briquetted Australian lignite can be successfully carbonized by the low temperature method, giving a high grade coke and moderate yields of tar and gas. Commercial success or failure will depend only on the economics of the situation; technically the process is sound, and the Australian lignite deposits are among the largest in the world.

LUBRICATING OILS. J. Herzenberg. *Braunkohle*, July 14, pp. 628-33. A comparison of the lubricating properties of tar oils and petroleum oils. Effects of distillation over Na, of dehydrogenation and of other treatments are considered. The chemical composition of these oils is considered as a factor in lubricating quality.

VANILLIN. Alfred Wagner. *Chemiker-Zeitung*, July 4, pp. 525-6. An illustrated description of the factory scale production of vanillin, starting with the preparation of isoeugenol from oil of cloves. The oil should contain 92 to 94 per cent of eugenol. For acetylation of the isoeugenol, a process is described which gives 92 to 95 per cent of the theoretical yield. Apparatus is described.

PAINT TESTS. M. Schults. *Zeitschrift für angewandte Chemie*, July 14, pp. 760-7. Specifications for rustproofing and preservation of structural materials are discussed. Varnishes and lacquers

are also considered. There must be thorough co-operation between maker and user if satisfactory specifications are to be agreed upon. The testing program is also extremely important. Some natural exposure (weathering) tests are described, as related to the particular requirements of specifications. Illustrated.

BUCKING LYE. Haller and P. Seidel. *Zeitschrift für angewandte Chemie*, June 23, pp. 698-702. In bleaching practice, the common prejudice against adding oxidizing agents to the bucking lye is in error; there is a distinct advantage. Activin is one of the best oxidizing agents for the purpose, because its reaction products are neutral and easily washed out. Those which will readily give off oxygen in an alkaline dye bath should be avoided.

BEAMHOUSE OPERATION. George D. McLaughlin. *Journal of the American Leather Chemists Association*, July, pp. 336-44. In curing hides for tanning, bacterial action is to be minimized by cleanliness and proper brine strength. The soaking and liming processes should be controlled so that all the objects of these treatments will be achieved. Application of scientific principles to proper control is discussed. One of the contributions of chemistry to progress is the recent observation that amines give that unhairing effect of sulfides without the damage which sulfides cause.

DYEING SILK. A. Thomson. *Journal of the Society of Dyers and Colourists*, July, pp. 202-5. A review of the application of direct cotton dyes, and of azo, mordant, sulphur and vat dyes to natural silk. The water soluble vat colors have the advantage that the dye-bath can be exhausted; but they are difficult to apply on account of oxidation. Gilding, weighting and the dyeing of union goods are considered.

ELECTRIC FIELDS. H. Gehlen. *Zeitschrift für angewandte Chemie*, June 30, pp. 714-6. In view of the interesting and sometimes remarkable effects of magnetic or electric fields on chemical reactions, methods of generating very high tension fields are described. For magnetic fields a modified Kapitza method was used and fields up to 320,000 gauss were obtained. It is expected that this can be increased, with the same apparatus, to 900,000 gauss. Electrical fields up to 1,700,000 were obtained with the aid of a wire net collector erected at a height of 80 m. between hilltops 760 m. apart. It is believed that this voltage can be considerably increased. Some effects, e. g. of magnetic fields on the electrical resistance of metals, and of electrical fields on polymerization and other chemical changes, are cited.

EXPLOSIVES. Alfred Stettbacher. *Zeitschrift für angewandte Chemie*, June 30, pp. 716-8. Pentaerythrite tetranitrate is an explosive having extraordinary brisance. It can be detonated by a trace of lead azide, giving explosions of remarkable force. On account of its high melting point it must be compressed; and the greater the pressure the less the sensitivity becomes. Pres-

tures up to 6,000 atm. have been tried experimentally. It is hoped that the technique can be so developed as to make possible the use of large (up to 5 cm.) detonating cartridges, thus eliminating the expensive and dangerous tube detonator. Such an advance would write a new chapter in the history of explosives technology. A plastic explosive can be made by blending with nitroglycerin, without sacrificing the detonating properties.

OXIDIZED COAL. Jas. T. Donnelly, C. H. Foott, Harald Nielsen and Joseph Reilly. *Journal of the Society of Chemical Industry*, July 13, pp. 189-92T. Pre-oxidized coal, distilled at 600 deg. C., yields an unstable reddish tar which darkens in air; but the stability increases with increasing pre-oxidation. A table shows the yields of heavy tar, light tar, water, gas, coke, and the per cent absorbed by P_2O_5 and by activated carbon, for varying degrees of pre-oxidation from 0.63 to 4.37 per cent oxygen taken up by the coal. Curves are also shown.

JIROTKA PROCESS. G. Kutscher. *Farbe und Lack*, July 11, pp. 313-4. Illustrated description of the technique for applying protective coatings to light metals such as aircraft alloys, the surfaces being first prepared by the Jirotk process, in which oxide layers are removed and the bare metal exposed by controlled immersion in a suitable brine solution.

POROUS CONCRETE. Julius Meyer. *Chemische Fabrik*, July 4, pp. 403-4. In making porous concrete, the method of incorporating a viscous foam in a cement composition is sometimes used, but the prevailing practice is to use a blowing agent in a plastic cement mix. This agent should be one which gives off gas by the action of water, not one which requires a special reagent or which, like Al powder, uses up one of the useful components of the cement mix. Other requirements are also discussed. There is as yet no thoroughly satisfactory blowing agent.

THERMOCOUPLES. Horst Brückner. *Chemische Fabrik*, July 4, pp. 406-8. Among the noteworthy applications of thermoelements in chemical industry is a recording device, with automatic alarm attachment, for registering the presence of oxygen in hydrogen or nitrogen or their mixtures. It is one of the instruments of synthetic ammonia manufacture, but has other uses also. Another useful thermoelement instrument is the recording heat content meter for controlling the thermal value of fuel gases within specified limits. Illustrated.

SULPHONATED OILS. C. Riess. *Collegium*, 1928, No. 6, 298-301. A sulphonated oil which is washed several times with a brine solution gives aqueous solutions which are neutral to methyl orange (pH about 4). This partial neutralization by brine washing effects a saving in neutralizing agent. A pH curve is shown, from which helpful information concerning the degree of neutralization of an oil can be derived.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from the bureau responsible for issue.

The Value of Inert Gas as a Preventive of Dust Explosions in Grinding Equipment, by Hylton R. Brown. U. S. Department of Agriculture Technical Bulletin 74. 5 cents.

Thermodynamic Properties of Oxygen and Nitrogen, by Russell W. Millar and John D. Sullivan. Bureau of Mines Technical Paper 424. 15 cents.

Safety Code for Mechanical Power-Transmission Apparatus, First Revision—Rules for Guarding Prime Movers, Intermediate Equipment, and Driven Machines. U. S. Bureau of Labor Statistics Bulletin 463. 10 cents.

Soil-Corrosion Studies, I. Soils, Materials, and Results of Early Observations, by K. H. Logan, S. P. Ewing, and C. D. Yeomans. Bureau of Standards Technologic Paper 368. 50 cents.

Effect of Testing Method on the Determination of Corrosion Resistance, by H. S. Rawdon and E. C. Groesbeck. Bureau of Standards Technologic Paper 367. 20 cents.

Cause and Removal of Certain Heterogeneities in Glass, by L. W. Tilton, A. N. Finn, and A. Q. Tool. Bureau of Standards Scientific Paper 572. 10 cents.

Alphabetical Index and Numerical List of United States Government Master Specifications, Promulgated by the Federal Specifications Board (Complete to January 1, 1928). Bureau of Standards Circular 319, 3d edition.

Crushing and Grinding Studies of Quartz, by John Gross and S. R. Zimmerley. Bureau of Mines Serial 2880.

Flotation of Fluorspar Ores for Acid Spar, by Will H. Coghill and O. W. Greeman. Bureau of Mines Serial 2877.

Use of Acetylene Tetrachloride Method of Porosity Determination in Petroleum Engineering Field Studies, by Chase E. Sutton. Bureau of Mines Serial 2876.

Production statistics from 1927 Census of Manufacturers in preliminary mimeographed form for: Production of Tin Oxide and Cane Sugar Refining.

Benzol Poisoning as a Possible Hazard in Chemical Laboratories, by J. J. Bloomfield. Public Health Reports July 20, 1928, U. S. Public Health Service.

U. S. Government Master Specifications, issued by the Bureau of Standards. The following are issued as Federal Specifications Board Specifications of the numbers designated: Technical Trisodium Phosphate (Phosphate Cleaner), No. 558; Copper Nickel Alloy Castings, No. 578; Acetone, No.

577; Manganese Bronze Rods, Bars, Shapes, and Plates, No. 552. The following two are issued as Bureau of Standards Circulars, at 5 cents each: Integral Waterproofing Material (For Use with Portland Cement Mortar or Concrete), Circular 360; Packing Flax, Circular 363.

Federal Anti-Trust Decisions, Volume 10. Cases decided in United States courts arising under, involving or growing out of the enforcement of the Federal Anti-Trust Acts, including a few somewhat similar decisions not based on these acts, 1923-27. Issued by the Attorney General. \$2.75.

Union Scales of Wages and Hours of Labor, May 15, 1927. Bureau of Labor Statistics Bulletin 457. 35 cents.

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Miscellaneous Publications

The Nichols Building for Chemistry. Privately printed: New York University. The addresses held at the dedication of the Nichols Building are now issued in this handsomely bound and printed volume, supplemented with photographs.

Soil Research, Vol. I, No. 1, International Society of Soil Science. This booklet is a supplement to the proceedings of the Society and contains four papers: one in French, one in German and two in English. The subjects are respectively colloidal clay, soil saturation, mechanical analysis, and alkali soils in Russia.

Studies on Sugar Boiling, by J. G. Thieme. Published by *Facts About Sugar*, New York. A translation of the Dutch version of the author's thesis first published at Jena. From the standpoint of boiling, beet and cane juices are fundamentally different and since the tables for the former are not applicable to cane sugar, new industrial tables have been prepared. Another feature is the formulation of rules for predetermining grain size.

Silica in Canada, Part II—Western Canada. By L. Heber Cole. Department of Mines, Ottawa, Canada. A 56-page report covering the occurrence, exploitation and uses of silica in Western Canada. It is well prepared and is equipped with tables and a set of photographs.

Supplement to Bulletin No. 2, Mellon Institute of Industrial Research. By Lois Heaton. A list of books, bulletins, journal contributions, and patents, domestic and foreign, by members of Mellon Institute during the calendar year 1927. Sent on request.

Tunnel Kiln Symposium. Technical Bulletin No. 23, American Refractories Institute. A number of tunnel kiln installations for burning brick and refractory shapes are discussed by builders and users. Among other valuable information, it is emphasized that high fuel efficiency in tunnel kilns depends, not on the type of fuel used, but rather on operation at full capacity.

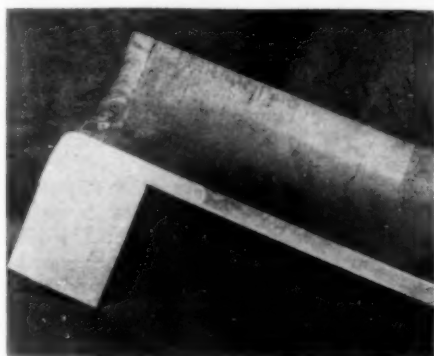
THE PLANT NOTEBOOK

an exchange for OPERATING MEN

Atomic Hydrogen Welding and its Applications

By F. D. BLANCH
General Electric Company,
Schenectady, N. Y.

In welding by the atomic hydrogen method, an alternating current arc is maintained between two tungsten electrodes, and through the arc and around the electrodes a stream of hydrogen gas is passed. The heat of the arc breaks up the molecules of hydrogen into atoms



Boiler Plate Welded to 13 Per Cent Chromium Steel

which recombine outside the arc to form molecular hydrogen again. The very intense heat given off by the atomic hydrogen as it recombines to form the molecular hydrogen is used to fuse the metals to be welded. The tungsten electrodes do not enter into the weld, the electrodes being used only as a means for establishing and maintaining the arc. They are, however, slowly vaporized by the intense heat of the arc.

Unlike the ordinary electric arc process of welding, the piece of metal being welded does not form a part of the electric circuit and, therefore, does not need to be insulated or grounded. The actual manipulation of the electrode holder is similar to the manipulation of the gas torch used in oxy-acetylene welding. The flame is played over the edges to be joined and fuses them together. On thick stock a filler rod may be fused into the weld to obtain the necessary strength.

The arc is maintained constantly but is capable of adjustment over a wide range of size and intensity and is, therefore, adaptable for a wide range of work. The temperature of the arc is in the neighborhood of 4,000 deg. C., as compared with approximately 3,200 deg. for the oxy-acetylene flame.

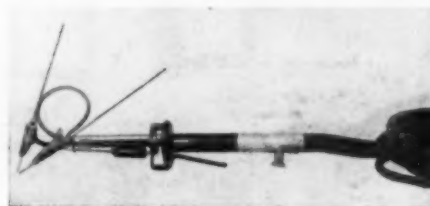
The hydrogen gas serves a three-fold purpose: first, it is a very efficient heat intensifier; second, it protects the

tungsten electrodes which would oxidize rapidly in air at a fairly low temperature; and third, it is an active reducing agent and protective covering for the molten metal and prevents the formation of oxides and nitrides thus making possible a very strong and ductile weld which has an exceptionally smooth and finished appearance.

The amount of heat available for welding depends upon the amount of hydrogen disassociated, and the amount of hydrogen disassociated depends upon the arc current. Hence the thicker the stock to be welded, the greater will be the arc current required to produce the necessary amount of heat. Standard equipment is available for operation from 110, 220, 440, or 550 volt, 50 or 60 cycle sources of supply.

The atomic hydrogen welding equipment consists of the following: (1) Transformer for changing the voltage of the supply circuit to that required for welding; (2) Variable reactor which automatically controls the arc and maintains the desired current; (3) Holder for mounting the tungsten electrodes and the orifices by means of which the hydrogen is supplied to the arc; attached to the holder is a twin conductor cable for connecting the electrodes to the welding current supply and a length of gas tubing for supplying the hydrogen; (4) Control panel mounting the variable reactor and the necessary instruments.

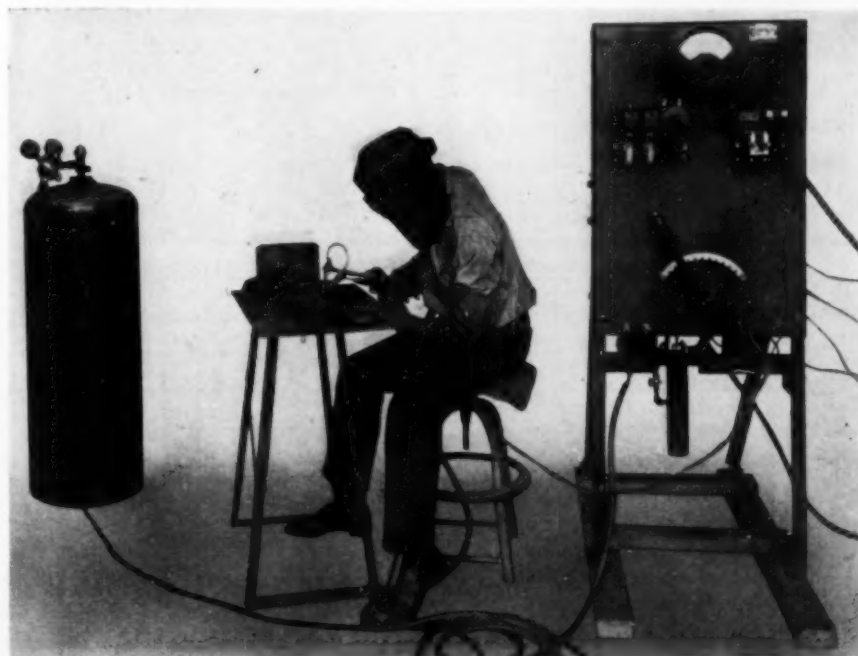
The electrode holder is shown in an accompanying illustration. The



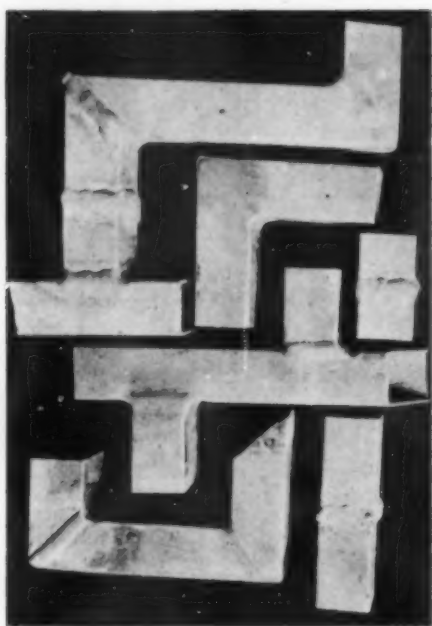
Atomic Hydrogen Welding Torch

reactor, a rectangular core fitted with windings, has a pivoted armature which in its normal position has a large air gap. In this position the reactance is a minimum and the maximum current is available for starting the arc. When current starts to flow in the circuit, the magnetic forces tend to rotate the armature toward the closed position; reducing the air gap, increasing the reactance, and decreasing the current. An adjustable stop limits the rotation of the armature, thereby holding a predetermined air gap and welding current. When the arc is broken the armature automatically returns to the open position, that most favorable for striking the arc, and the arc circuit is automatically disconnected from the power supply circuit.

Two sizes of tungsten electrodes are used: $\frac{1}{8}$ -in. diameter and $\frac{1}{16}$ -in. diameter. For arc currents up to 35 amp. the $\frac{1}{8}$ -in. size is used and from 35 to 60 amp. the $\frac{1}{16}$ -in. size is used. If currents greater than 35 amp. are applied to the $\frac{1}{8}$ -in. diameter electrodes, these will



Atomic Hydrogen Welder in Action



Welds on Aluminum-Zinc-Manganese Alloy

be consumed at an abnormally high rate.

The atomic hydrogen process of welding is not entering the field as a competitor of metallic arc welding for general manufacturing and repair work in the fabrication of iron and steel; it is more of a supplementary process, adding to and extending the field of welding. Its particular field of application will most likely be in the welding of thin plates and certain alloys and non-ferrous metals that have heretofore been unweldable with the ordinary arc.

The following is a brief outline of the extent to which the process, as thus far developed, may be applied to the welding

of various commercial metals and alloys:

Steel—In general all varieties of steel including the nickel, chromium, molybdenum, and manganese steel alloys are readily welded. Steel with carbon content as high as 1.25 per cent has been successfully welded. High-speed steel tips can be welded to low carbon shanks. Welds made on steel with the atomic hydrogen process are very strong and extremely ductile, the metal flowing quietly and evenly under the hydrogen flame and producing a weld with a smooth, finished appearance.

Cast Iron—Thin sections of cast iron can be readily welded and holes in malleable castings patched. In welding thick sections of cast iron, where it is necessary to use filler rod, the difficulties are much the same as in welding cast iron by the metal arc process.

Chrome Steel—Ascoloy (12 to 16 per cent chromium) and chromium steels up to 40 per cent chromium are readily welded but the welds are quite hard and brittle. If the chromium content is not over 20 per cent this condition may be corrected by subsequent heat treatment, but it is doubtful that heat treating improves the quality of the weld when the chromium content is greater than this. Welds made on Superalloy (17 to 20 per cent chromium and 7 to 10 per cent nickel) are strong and ductile.

Manganese Steel—Readily welded.

Nickel—Also readily welded.

Nickel Chromium Alloys—Good welds can be made on Calorite (15 to 20 per cent chromium and 85 to 80 per cent nickel) such as is used for resistance units and heaters for electric furnaces. Castings of this material can also be satisfactorily welded.

Monel Metal—Welded satisfactorily.

Copper—Copper is difficult to weld on account of its tendency to form small blow holes. So far, good results have been obtained only when the metal has been preheated.

Bronze—High copper bronzes are difficult to weld for the same reason that applies to copper.

Brass—With over 40 per cent zinc, brass becomes difficult to weld. A flux is required to make good welds on brass. Sodium chloride has been found very satisfactory.

Aluminum—Aluminum can be readily welded, a flux being required. Good welds made on sheets as thin as 24-gage.

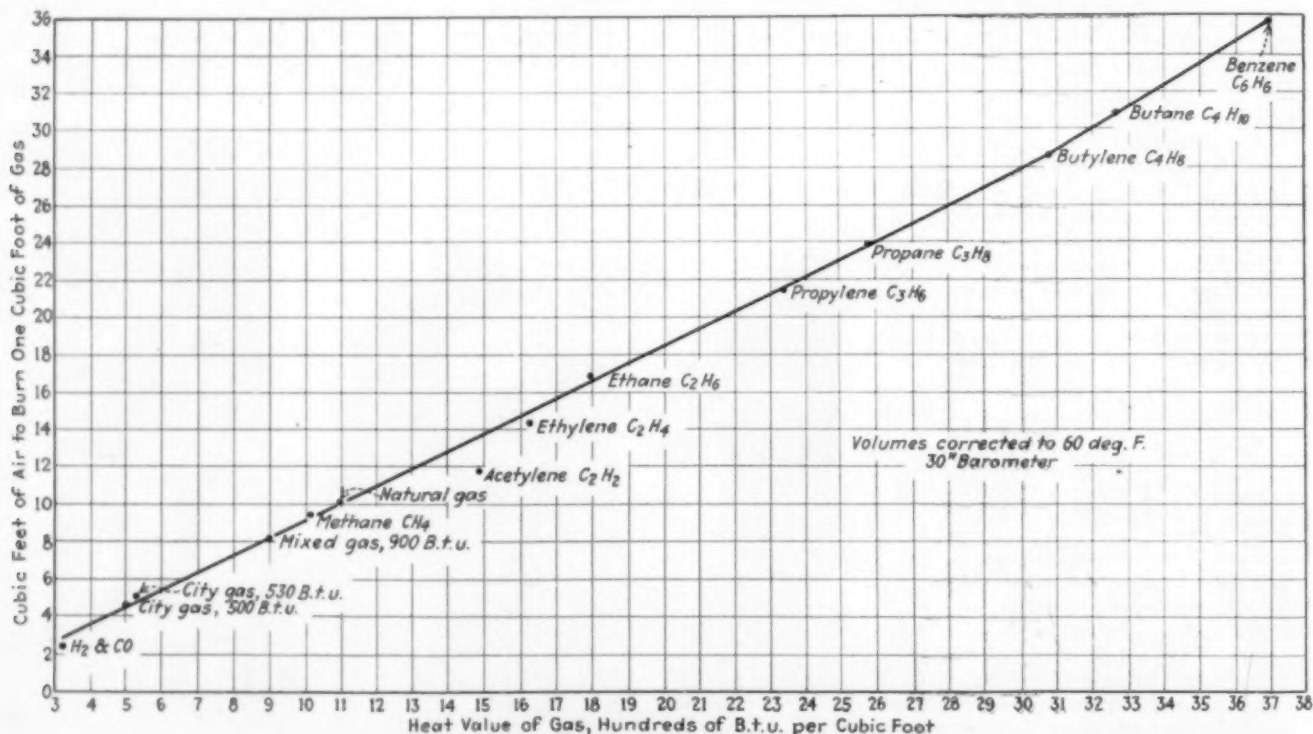
Duraluminum—As in the case of aluminum a flux is required.

Zinc—While very little work has been done, sample welds on $\frac{1}{8}$ -in. commercially pure zinc plate have been made which were as ductile as the rolled zinc plate.

Molybdenum, Silver, Tungsten—Very little experimental work has been done, but indications are that these metals can be satisfactorily welded.

Conveyor Lock

A simple device for locking a conveyor and preventing its backward motion in case of a failure of power supply was described in a recent issue of *Coal Age*. A small steel or paper roller is allowed to float on the belt between the head pulley and the main idler. As long as the conveyor is moving in the proper direction, the roller simply rides against the head pulley and the conveyor belt. Immediately upon reversal, however, the roller is wedged between the head pulley and the idler, thus very effectively locking the conveyor.



Heating Values and Air Requirements of Commercial Gases

Air requirements for combustion of any hydrocarbon gas may be obtained approximately from the curve when the heating value is known.

By L. G. JONES, Baltimore, Md.

EQUIPMENT NEWS

from MAKER and USER

Stream-Line Filter

A principle of filtration about which comparatively little has been written in this country, but which is well understood and quite generally utilized in England, is that known as stream-line or "edge" filtration, which was originally announced in 1923 by its discoverer, Dr. H. S. Hele-Shaw. *Chem. & Met.* carried a number of brief articles concerning the filter in the latter part of 1923, but changes in the application of the principle have been radical since that time.

It is told that Dr. Hele-Shaw was attempting to pass a colored liquid containing exceedingly fine material in suspension between blocks of plate glass separated a distance equal to the thickness of a thin sheet of paper. He noticed that the effluent was perfectly clear although the suspended material was so fine as to pass through any ordinary filtering medium. He further observed that the solids were retained completely on the edges of the glass blocks, and that none penetrated into the fluid passages.

In an effort to make practical use of this discovery, Dr. Hele-Shaw next built up a column of thin, waterproofed

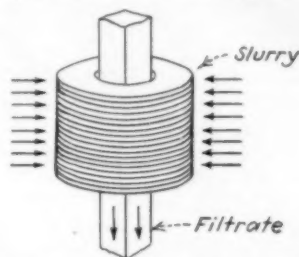


Fig. 1—Stream-Line Filter Element Showing the Principle of Operation

paper washers which were held together by passing a square rod through the circular bore of the pack and clamping plates to the rod, above and below the washers, so that pressure could be applied along the rod to press the washers together. It was found that the filtering effect was greatly magnified and that even certain colloids could be completely filtered out of suspension. Furthermore, it developed that the filter could be easily cleaned by reversing the flow or by blowing the cake of deposited solids by means of compressed air from the inner passage. Fig. 1, showing an elementary block of paper washers, makes the principle of stream-line filtration clear.

Since its discovery, the stream-line filter has been rapidly developed by Dr. Hele-Shaw and his associates of the Stream-Line Filter Company, Ltd., 64 Victoria St., London, S. W. 1. It is

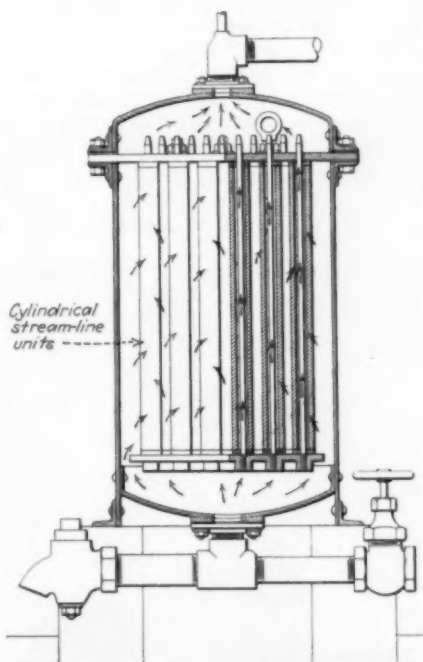


Fig. 2—Water Filter Which Makes Use of Cylindrical Elements of the Type Shown in Fig. 1

finding wide application in the purification of fuel and lubricating oils, water for drinking, beverage and industrial purposes, oily bilge water, and for general filtration purposes in the form of column, rotary disk and leaf filters and filter presses in the chemical and metallurgical industries. Paper, specially processed to render it impervious to the filtered material, is used in the form of round or flat packs, and is said to be very long lived and much more effective than a filtering medium which depends upon passage of the liquid through its pores or interstices. One claim that is especially stressed is that the solids rarely if ever penetrate between the paper layers, and that, as a

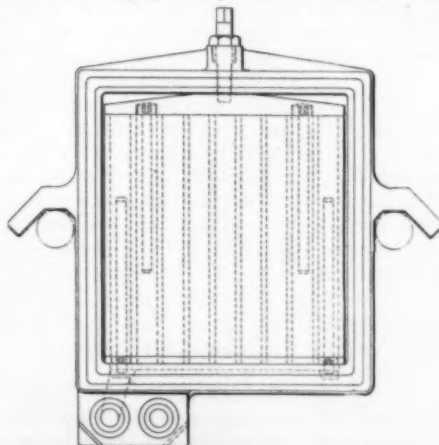


Fig. 3—Filter Press Plate Employing Flat Stream-Line Filter Elements

consequence, there is never any difficulty in cleaning the filtering surface.

A very obvious advantage of "edge" filtration lies in the ease with which the pressure holding the pack together may be varied to suit the requirements of specific filtration problems. For very fine filtration, pressures of over 200 lb. may be applied to the paper with filtering pressures of equal magnitude or greater. It is said that, even at these high pressures, there is no danger that the filter units will be collapsed. As an example of what can be accomplished in the way of fine filtration, the following is cited: A concentrated neutral precipitate of barium sulphate, obtained by mixing solutions in the cold, which readily passed through the best filter papers, was entirely removed in one passage through the stream-line filter. Prussian blue is said to be filtered with equal facility.

The usual types of filter media do not reach full clarification efficiency until some of the solid being filtered has clogged the interstices and built up on the surface of the medium to a certain extent. It is frequently necessary to refilter a part of the early filtrate or to discard it entirely. This is never necessary with the stream-line filter, in the

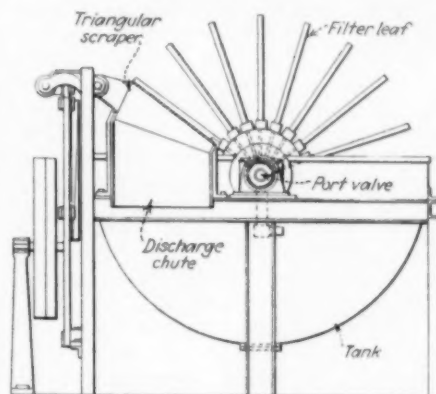


Fig. 4—Rotary Continuous Paddle Filter With Flat Stream-Line Filter Elements

opinion of its sponsors, as there is no penetration and full clarification efficiency is reached immediately. For this reason it is possible, in the continuous types of filters, to work with exceedingly thin cakes and consequent high filtering rates. As an example of the retarding effect of the building up of a cake, on the rate of filtration, the following figures are given: In a typical case, the filtration rate for zero cake thickness is 170 g.p.h. With a cake of 0.02 in. the rate drops to 25 g.p.h. Doubling this thickness reduces the rate to about 12. With a cake of 0.12 in. the rate drops further to 5 g.p.h. Rotary disk and leaf (paddle) filters make use

of this with the result that very high filtering rates are attained.

Three applications of the stream-line filter principle are illustrated in the accompanying drawings. Fig. 2 shows a water filter for 1,000 g.p.h. capacity. It occupies a space only 3 ft. high by 2 ft. in diameter. The filtering element consists of 40 stacks of round paper washers which are easily cleaned by reversing the flow, and simply removed in case of replacement. It is said that the entire filtering surface may be replaced within half an hour.

In Fig. 3 is a single plate for use in a plate-and-frame filter press. The element consists of a large number of narrow strips of paper strung upon guide rods and compressed by means of the screw at the top. Holes through the strips register with each other and are closed off at the top, but communicate with a channel leading to the lug at the bottom. Two holes are cored through the lug, one of which is connected with the filtrate channel. Alternate plates connect with different lug holes so that, when the plates are installed in a filter press with suitable frames interspersed, filtrate is discharged through the two lug channels. The purpose of the two channels is to provide for effective through-washing of the press. Wash water is passed in through one channel whence it enters alternate filter plates and flows in both directions through the two adjacent cakes and discharges through the second set of plates and their channel. Flow is then reversed to ensure most thorough washing.

ATYPE of rotary paddle filter appears in Fig. 4. In a typical filter of this kind, the elements are made up of strips of paper $6\frac{1}{2}$ in. long by $\frac{7}{8}$ in. wide, with nine holes along the length. Blocks, consisting of a large number of strips are penetrated from end to end with a series of tubes or perforations which serve as channels. Two through-rods align the strips. A number of the blocks are assembled side by side in frames to form the filter leaves. The frames are provided with means for applying pressure to the paper to hold the blocks firmly together.

The ends of the channels at the outside are closed off, while those at the inside of the leaves communicate with a passage connected to a port valve. This valve is of a type similar to the familiar application in the ordinary rotary filter. Through it, vacuum and air services are provided at the proper times to cause the filter to attach the cake, dry it somewhat, and discharge it at the proper point in the cycle. The filter turns intermittently in order that the leaves may be scraped. This function is accomplished by a mechanism which advances the filter one leaf, stops and locks it and finally pushes a triangular scraper between, and in contact with, one side each of two adjacent leaves. Stirring mechanism is unnecessary with this filter, for keeping the solids in suspension, as the dredging and paddle action of the leaves prevent any settling.

Continuous Automatic Sampler

A new automatic sampling device known as the "Samplitt" has recently been introduced by Max B. Miller & Company, 201 Fifth Ave., New York. It is shown in the accompanying illustration, installed in a crude oil line for continuously withdrawing a small sample of the flowing crude and ejecting the sample into a container.

The operation of the "Samplitt" is easily understood. A casing, containing an impeller wheel, is located in the line from which the sample is to be taken, so that the flowing liquid will rotate the impeller at a speed proportional to the rate of flow. Through reduction gearing, the impeller slowly rotates a



"Samplitt" Installed in Oil Line for Sampling Oil From Tankers

four-way cock which connects a point at the bottom of the impeller casing alternately with the two opposite ends of a pump cylinder containing a free plunger. Simultaneously, the cock connects the alternate ends of the cylinder, through a small line rising from the "Samplitt," to a container for the sampled material.

As the pressure in the sample container is less than that on the line, when the cock makes a connection with one end of the pump cylinder, the line fluid pressure forces the plunger to the extreme of its travel, leaving the cylinder full of the material to be sampled. As the cock continues to rotate, the opposite end of the plunger is subjected to the line pressure, and the contents of the first end of the cylinder are ejected to the sample container. This procedure continues at intervals ranging from 15 to 75 seconds, dependent upon flow in the line, as long as the flow does not drop below the figure for which the "Samplitt" is recommended.

The plunger, which serves the double purpose of metering and ejecting the samples, is adjustable as to stroke. While the proportionality between the

rate of line flow and the number of samples taken in a given time will always remain constant within the accuracy of the instrument, the volume of each sample may be regulated at will within wide limits. Regulation may be accomplished while the device is in operation. Six sizes of "Samplitt" with maximum capacities ranging from 75 to 9,000 bbl. line flow per hr. are available, and may be supplied in special materials to meet any reasonable requirements of users.

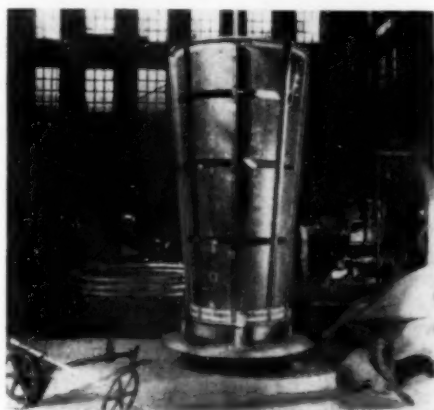
The manufacturers claim that the "Samplitt" is extremely accurate and will sample, within close limits, that proportion of the total flow of liquid, for which it is set. Due to the turbulence which is created in the line at the impeller, both by the action of the impeller and by the change in size and shape of the line at that point, it is said that a truly representative sample is taken. In addition, the device eliminates the necessity for hand sampling, with its probable inaccuracy and its labor requirement. The "Samplitt" is recommended for use in any line carrying a liquid which is to be sampled frequently. Uses at present have embraced the sampling of oils at many points in the refinery. It is further suggested for such purposes as sampling chemical plant effluents, coal and water gas tar, molasses, gas oil and wood preservatives.

AMODIFICATION of the "Samplitt" is called the "Mixitt." The principal change consists in the elimination of the gearing between the impeller and the four-way cock so that, for average circumstances, the injection cycle is repeated about 400 times a minute. Instead of withdrawing samples, however, the pressure in the line is made less than the pressure in a container filled with a reagent which it is desired to inject continuously, and in measured proportion, into the liquid flowing in the line. The result is that the reagent pressure operates the plunger pump at a speed controlled by the rate of rotation of the cock—that is by the speed of flow in the line—and the reagent is injected in small measured amounts, at frequent intervals, into the line. This operation is reverse but exactly analogous to the action of the "Samplitt." Also, as in the case of the "Samplitt," injections may be controlled in amount at the will of the operator.

A small difference in pressure between the main body of liquid in the line and the reagent is said to be all that is necessary to operate the "Mixitt." It is claimed, that here again, turbulence in the line, at the point of the feeding of the reagent, is so great that thorough mixing of the reagent with the entire body of the passing liquid is secured. "Mixitts" are suggested for such uses as adding acid continuously to gasoline and kerosene, treating water supplies and preparing dye solutions. Accuracy of proportioning is claimed. "Mixitts" are obtainable in various materials to suit the user and in sizes ranging from $62\frac{1}{2}$ to 9,000 bbl. per hr. maximum capacity for line flow.

Venturi Slurry Agitator

Managers of wet process portland cement plants will be interested in a new slurry agitator which has been named the "Venturex" and which has been developed and placed on the market by Smith and Smith, 15,614 Detroit Ave., Lakewood, Ohio. Shown in the accompanying cut, it will be seen to consist principally of a venturi-like vertical casing in which rotates a power-driven screw propellor. The casing consists of a cast metal, constricted throat in which the propellor is located, surmounted by a sheet-iron casing strengthened by iron rings, and open in a number of horizontal planes to permit entrance of the slurry. Below the propellor and venturi



Venturex Slurry Agitator

throat is a flared exit for the mixed product at the bottom of the agitator. Circulation of the slurry is in through the top of the casing and through the side slots, and down past the propellor, out the bottom, and up the walls of the containing tank outside the "Venturex." To provide for starting up the mixer, the sheet metal cone is arranged on guides to permit its being raised a few inches away from the throat to present an additional opening.

It is claimed for the new agitator that it is self-cleaning and thorough in its action and that it was developed under actual cement mill conditions. Electric power for its operation is said to be unusually low. All bearings but one, a water-lubricated bearing at the base of the shaft, are outside the tank and protected from contamination while the latter is said to be itself well protected from abrasion.

Acid Resisting Alloy

The Barber Asphalt Company, Philadelphia, has developed and is now ready to market "Barberite," a high copper bronze alloy containing nickel. The manufacturer claims that the new alloy has corrosion resisting properties superior for many uses to various white nickel alloys and other high copper bronzes. Its high tensile strength is comparable to mild carbon steel. The alloy may be cast and is said to give a very fine crystalline structure which is uniformly strong and easily machined.

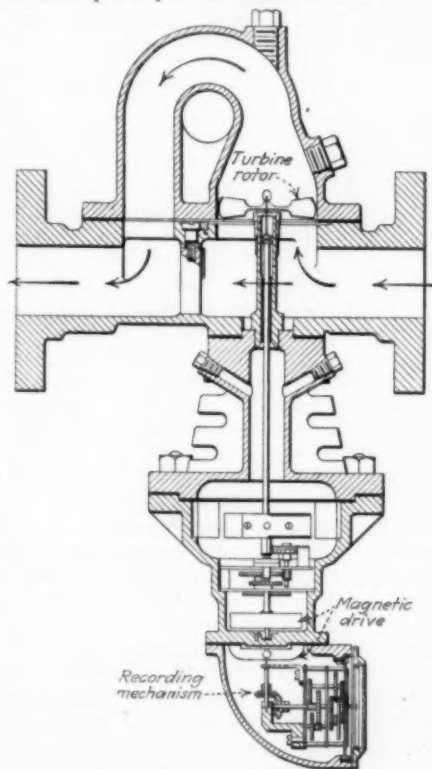
A test of "Barberite" in 83 per cent sulphuric acid at 96 deg. C. showed a loss equivalent to 0.0819 grams per sq.cm. per year. The alloy is recommended for use with sulphuric acid of any strength at any temperature up to 205 deg. F. It is also recommended for use with such acids as arsenious, boric, fatty acids, pyrogallic and various other organic acids. It is suggested for use with strong alkalis and with various salts of both strong and weak acids. It is further recommended for use with a number of alcohols and solvents.

"Calibrated" Spray Gun

The Alexander Milburn Company, Baltimore, Md., is now marketing a new paint spray gun, Type EF, which incorporates two dialed adjustments, one for the shape of the spray and the other for its volume, which permit, it is said, the duplication of the exact conditions found most satisfactory for any class of work at any time. When the proper adjustments have been determined, a record of the gun's "calibration" will enable an operator to produce the same class of work without further experiment, whenever necessary.

Shunt Meter

A development in meters, new in this country, is that of the shunt meter, type KS, which is announced by the Builders Iron Foundry, Providence, R. I. This meter is adapted to the measuring of smaller amounts of steam, air or various gases. The accompanying drawing makes clear its principle. A portion of the main flow of the gas is shunted by a baffle plate past a small turbine rotor



New Shunt Meter for Gases

whose motion is damped by a fan submerged in condensate water, and reduced by a train of reduction gears. A magnetic drive, permitting the elimination of stuffing boxes, drives a counting mechanism for recording the gas flow volume. Meters are made in sizes from 2 to 4 in. and may be used in larger lines when installed in a bypass around an orifice in the main line.

The meters are available in pressures ranging from 0 to 300 lb. per sq.in., and for temperatures to 600 deg. F. They are said to be accurate within 2 per cent, except at very low capacity. The meter is intended for the measurement of any of the various process gases used in steel, chemical, paper and miscellaneous industrial plants.

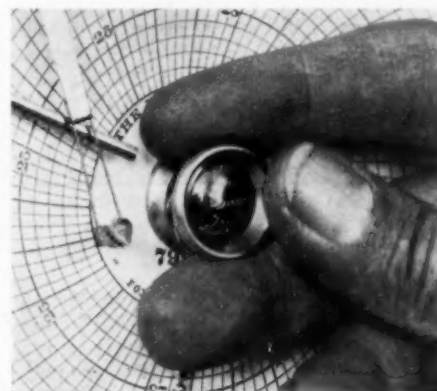


Chart Hub for Foxboro Recording Instruments

Chart Hub

The accompanying illustration shows a new hub for recorder charts which has been introduced by the Foxboro Company, Foxboro, Mass. The new hub is supplied on instruments of current manufacture of this company, and with the installation of a new spindle, may be adapted to the older instruments as well. The hub is without threads and requires only a touch on the push button to release it. It is said to center the chart accurately and to hold it firmly in place. A twist of the hub will adjust the chart for correct time without the necessity of removing the chart holder.

Protected Motor

A new type of protected, fan-cooled motor, which may be pipe-ventilated, or totally inclosed for severe requirements, is now being produced by Sterling Electric Motors, Inc., Los Angeles, Calif. This company specializes in protected motors in sizes ranging from $\frac{1}{4}$ to 30 hp. for 50 and 60 cycles, in voltages ranging from 110 to 550, in single or polyphase construction, with 40 deg. rating. The motors are adapted to cross-line starting, and are equipped with anti-friction bearings. Protection is provided by a copper shield within the casing, inclosing the rotor and windings, over which a current of air may be blown by a circulating fan mounted upon the rotor shaft.



Massive Fused Silica Roll

Vitreosil Rolls

A recent development of the Thermal Syndicate Ltd., 58 Schenectady Ave., Brooklyn, N. Y., is that of the heavy-walled fused silica cylinder. The cylinder illustrated consists of a tube of 2½ in. inside diameter by 6 in. external diameter. The heavy wall of such a product offers increased mechanical strength, and is said to be adapted to withstand extremely severe chemical and thermal conditions without injury.

The cylinders are suggested for installation in connection with high temperature dielectric stresses under corrosive conditions. High pressure reactions in the gas phase at elevated temperatures, with or without corrosion, also form a field for the newly developed product. The cylinders may be ground and polished if required, and may be used as rolls in various fields of chemical technology.



Oil Film Type Air Filter

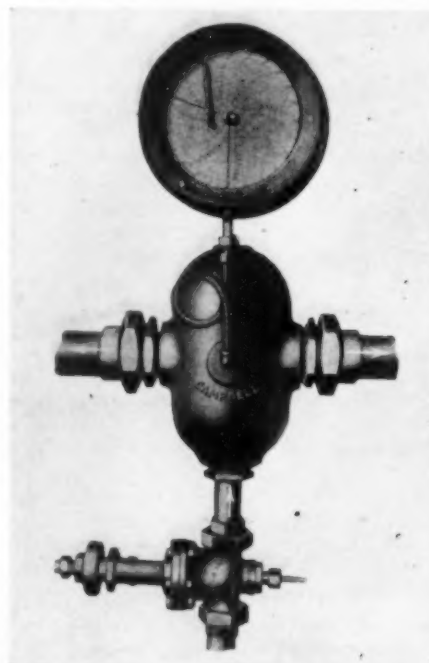
Oil Film Air Cleaner

A new "Simplex" air filter is now available as announced by the National Air Filter Company, Chicago. It consists of a large cylindrical drum, closed at one end and carrying a filter medium base composed of expanded metal and specially woven copper fabric. Oil which coats the filter base as the drum is revolved serves to remove the particles of dust from the air which is

drawn through the filter. The drum is turned by hand, or it may be arranged for power drive, at the rate of about one-fifth turn per week, allowing ample time for the detaching and settling of the dirt caught in the submerged panels. The new filter is made in sizes ranging from 800 to 40,000 c.f.m. of air and may be arranged in parallel with other units to give any desired capacity.

Steam-Flow Controller

A new series of steam-flow controllers has been introduced by the Campbell Engineering Co., Short Hills, N. J. These controllers consist of various combinations of receivers, calibrated nozzles, and recording or indicating instruments. They are to be



Steam Proportioner and Controller

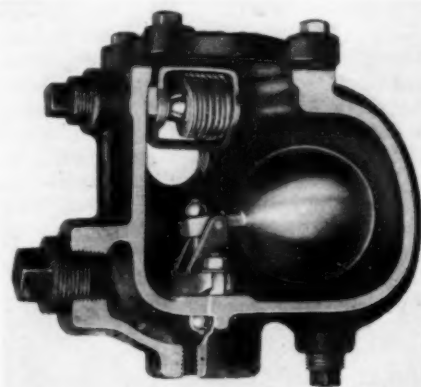
used in connection with hand-operated or automatic valves, and are used to control or proportion steam at various pre-determined rates. The controller illustrated herewith is a twin orifice type, with a recording instrument giving flow in lbs. per hour. By the use of two orifices, the steam discharge is proportioned in the ratio of orifice area between two points. For smaller quantities of steam two single orifice instruments may be combined with one indicator or recorder to proportion the steam between two points.

These controllers were developed primarily for regulating steam flow to oil stills, but are suggested also for use in connection with dryers, kettles and other steam heated equipment about the plant.

Steam Traps

Two new traps have been developed by the Sarco Company, 183 Madison Avenue, New York. The type FT consists of a combination float and thermostatic trap for 1½ in. lines or smaller.

Condensate is discharged by means of the float, while air is vented by means of a thermostatic bypass. The capacity of the trap ranges to 2,000 lb. of condensate per hour for a 10 lb. pressure differential. The weight of the trap is 15 lb. It is recommended for various

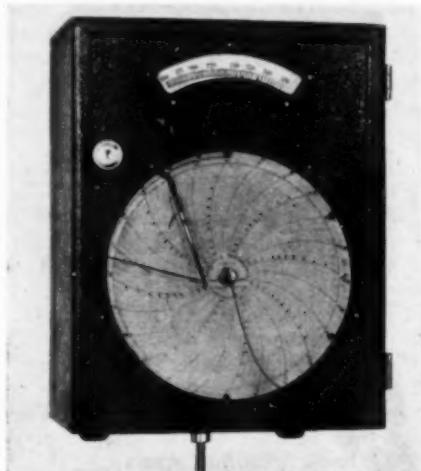


Combination Thermostatic and Float Trap

heating services at steam pressures up to 10 lb. A second trap, type S-75 is a development of the No. 9 Sarco self-adjusting thermostatic trap, and is intended for pressures up to 75 lb. It is supplied with a renewable Monel valve head and seat.

New Recorder Controller

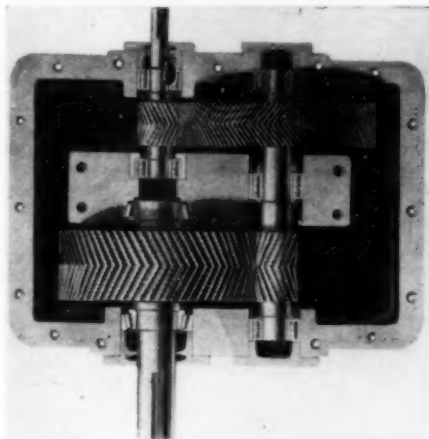
A new temperature controller with a single-pen recorder is now offered by the Bristol Company, Waterbury, Conn., and is given the designation of Model 267. Dual pressure elements are provided to operate the control contact and the recorder, controlled by a single sensitive bulb. The control feature, set at the desired temperature by an index pointer shown in the illustration above the record chart, is exercised through the making and breaking of an electric circuit controlling a motor- or solenoid-operated valve or a mainline switch for smaller electrically heated installations. This is made possible through a controller contact capacity of 1,000 watts. Zero adjustments on both the recorder and controller are provided to ensure the accuracy of the instrument.



New Model 267 Recorder Controller

Herringbone Reducers

Two improved speed reducers have been developed by the D. O. James Manufacturing Company, Chicago, Ill. They consist of single and double reduction types of generated continuous



Double Reduction Speed Reducer with Anti-Friction Bearings

tooth herringbone gear reducers, fully equipped with anti-friction roller bearings. Hyatt bearings are used on the high, intermediate and low speed pinion shafts and Timken bearings on the low speed gear shaft (and pinion shaft also in the single reduction model). The double reduction type is illustrated

Unit Air Conditioner

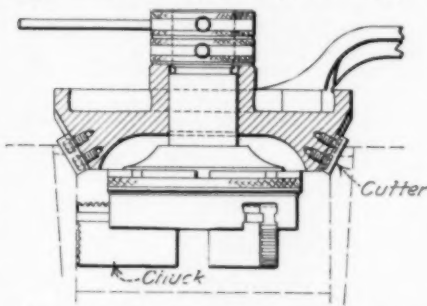
The Carrier Engineering Corporation, Newark, N. J., has recently announced a new unit air conditioner capable of conditioning and heating or cooling 2,500 cu.ft. of air per minute. The conditioner is inclosed in a cabinet which contains mechanism for spraying water, circulating the air and heating the air if required. Air enters the bottom of the cabinet and passes upward through a zone of atomized water, thence through a fan, through a set of eliminator plates, past a fin type heater and discharges into the room in which the conditioner is placed. Water, maintained at constant level by means of a float valve in a tank at the bottom of the conditioner cabinet, is atomized by a rotating device known as the "Centrijector" which is driven by the same 1 hp. motor which circulates the air.

The "centrijector" is said to use only about $\frac{1}{3}$ to $\frac{1}{4}$ of the power required for a centrifugal pump of equal capacity. It is capable of atomizing 27 gallons of water per minute at a pressure of 40 lb. per sq.in. at the nozzles, with a power consumption of only 0.4 hp. Mounted directly above the atomizer is a multi-blade centrifugal fan driven by a totally inclosed motor. Control of the steam supplied to the fin heater and control of the amount of water vaporized regulate the temperature and humidity of the air discharged from the conditioner. If cooled air is required, it is obtained by using the evaporative effect of the

air upon the make-up water. Dehumidification is obtained by supplying cool or refrigerated water. Efficient air washing is also claimed for the unit.

Tank Car Valve Reseater

A simple machine for the reseating of tank car valves has been put on the market by the Leavitt Machine Company, Orange, Mass. The accompanying drawing shows the reseater, which may be supplied in two sizes for 6 in. and 4 in. valves. It consists of a universal chuck surmounted by a cutter equipped with a feeding device. The chuck centers the machine in the valve and holds it in place. It is said that a few rotations of the cutter suffice to produce a new seat. The cutters may be supplied in any desired angle. It is claimed that an inexperienced operator may reseal a valve in a few minutes.



New "Dexter" Valve Reseating Machine

Variable Speed Transmission

A new variable speed transmission has been placed on the market by the Reeves Pulley Company, Columbus, Ind. While in appearance the new transmission is similar to the old, it is said to be more compact, stronger, and to deliver power with greater efficiency. A new type of V belt is now used which gives twice the surface of contact with the driving disks. The splice-block of the new belt is simpler and stronger. The frame has been strengthened and made more compact. Lubrication has been improved. An indicator has been incorporated to enable the operator to tell the approximate speed of the transmission at a glance.

Gas Analyzer

A new gas analyzer, working electrically on the principle of thermal conductivity, has recently been developed by Charles Engelhard, Inc., Newark, N. J. It is adapted to the analysis of practically any kind of gas used in industrial operations. It is claimed that it may be used to measure one gas as a constituent of a combination of gases. The analysis cell containing the heating element has been protected from vibration and corrosive gases so that it may be located anywhere within the plant with the recording or indicating instrument at any desired point.

Manufacturers' Latest Publications

Semet-Solvay Engineering Corp., 40 Recor St., New York, N. Y.—Publications as follows: Pamphlets No. 344 and 348, covering respectively location of Doherty washer cooler installations and the spray header used on the washer cooler.

Cleveland Crane and Engineering Company, Wickliffe, Ohio.—Form TR 601—regarding Tramrail Catalog No. 4.

International Nickel Co., 67 Wall St., New York, N. Y.—Discusses increased hardness of nickel iron castings.

Diehl Manufacturing Co., Elizabethport, N. J.—Reprint B, No. 1719—Describes various fans made by this company.

Electric Controller and Manufacturing Co., Cleveland, Ohio.—Folder on the new E C & M dinkey controller.

Linde Air Products Company, 30 E. 42nd St., New York, N. Y.—Bulletin on "Oxwelded Industrial Piping."

American Rolling Mill Company, Middletown, Ohio.—"Pure Iron Plates for Long Service," describing the durability, uses and available sizes of pure iron plates.

Crouse-Hinds Company, Syracuse, N. Y.—Publications as follows: Bulletin G-7 "Groundrods and Other Safety Circuit Devices"; Bulletin G-8, "Ground for Safety."

Lewis-Shepard Company, Watertown Station, Boston, Mass.—"Lewis-Shepard Engineering," a catalog of material handling equipment consisting of lift trucks, portable elevators, platforms and racks, and hand carting equipment.

The Superheater Company, 17 E. 42nd St., New York, N. Y.—Publications as follows: Steam tables giving properties of saturated and superheated steam from 0.0886 to 3,300 lb. absolute pressure. Also Bulletin T-1, a complete catalog concerning the Elesco superheater for power plants.

Pennsylvania Pump and Compressor Company, Easton, Pa.—Publications as follows: Bulletin 138 describes the Pennsylvania improved air cushioned valve; Bulletin No. 212, multi-stage centrifugal pumps, Class OMF.

Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill.—Publications as follows: Bulletin No. 128, "The Influence of Carbon in Steel Welding Rods"; also a folder describing the Fuson line of arc welders.

The General Electric Company, Schenectady, N. Y.—Publications as follows: GEA-37C, direct heat electric furnaces; GEA-263A, high-speed type KT motors; GEA-405A, constant-speed induction motors for elevator service; GEA-423A, automatic welding in GE factories; GEA-556A, automatic welding head and control; GEA-844, CR7-009-B12 magnetic reversing switch; GEA-874B type WD-200A arc welder; GEA-977, capacitor-motors, type RKS; GEA-992, automatic tank welder; GEA-995, arc welding in industry; GEA-998, totally inclosed motors for portable hoists; GEA-1,009, gas-engine-driven arc welder; GEA-1022, automatic arc welder for steel railroad ties; GEA-1031, type AW resistor arc welders.

Tennessee Eastman Corporation, Kingsport, Tenn.—A descriptive survey of the Tennessee Eastman Corporation, describing its plant and activities.

The Lincoln Electric Company, Cleveland, Ohio.—A new bulletin describing "Automatic Arc Welding by the Electronic Tornado Process."

Adam Hilger, Ltd., 24 Rochester Place, Camden Rd., London, N. W. 1, England.—A pamphlet on recent work on Absorption Spectrography.

Erie City Iron Works, Erie, Pa.—An article by W. J. Wohlenberg, on "Some Fundamentals of Water Cooled Furnace Design."

Mid West Air Filters, Inc., Bradford, Pa.—Publications as follows: Form F-5, concerning air filters; also a folder describing the new Mid West humidifier.

Warner Elevator Manufacturing Company, Cincinnati, Ohio.—Booklet on dumb waiters.

Hartford Accident and Indemnity Company, Hartford, Conn.—Second edition of "Spray Coating—Its Hazards and Safeguards."

R. Franche and Company, Villefranche s. Soane (Rhône), France.—Pamphlet comparing the Franche rotary compressor with compressors of other types.

Brown Instrument Company, Philadelphia, Pa.—Catalog No. 93—Complete catalog of Brown resistance thermometers.

PATENTS ISSUED

July 3 to July 31, 1928

PAPER, PULP, GLASS, AND SUGAR

Controlling Means for Calender Doctors. Frederick W. Lodding, Worcester, Mass., assignor to Rice, Barton & Fales, Inc., Worcester, Mass.—1,675,363.

Screen for Paper Making. Isaac Lauren Laird, South Walpole, Mass., assignor to Bird Machine Company, South Walpole, Mass.—1,675,612-3.

Apparatus for Feeding Molten Glass. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn.—1,675,819.

Process and Apparatus for Drawing Sheet Glass. George H. Harvey, Rochester, Pa., assignor of one-half partnership interest to Edward A. Lawrence, Bellevue, Pa.—1,676,027.

Paper-Pulp Shredder. Frank B. Philbrick, deceased, Waterville, Me., by Herbert S. Philbrick, executor, Evanston, Ill., assignor to Waterville Iron Works, Waterville, Me.—1,676,048.

Plate-Glass-Rolling Apparatus. Lee Showers, Charleroi, Pa., assignor to Pittsburgh Plate Glass Company.—1,676,056.

Process of Making Glass in a Shaft Furnace. Kurt Künzel, Ushmannsdorf, Germany.—1,676,267.

Paper Making. Roy Victor Weldon, Millinocket, Me., assignor to Great Northern Paper Company, Millinocket, Me.—1,676,305.

Heat Resistant Borosilicate Glass. Ludwig Hochstein, Wandbek, Germany, assignor to E. T. Brown, Thomaston, Me.—1,676,331.

Soaking Machine Employed in Making Paper. Charles T. Crocker, Fitchburg, Mass.—1,676,636.

Method and Means for Paper-Stock Refining. Harry Liebeck, Swarthmore, Pa., assignor to Scott Paper Company.—1,676,653.

Paper-Making Machine. William A. Lorenz, West Hartford, Conn., assignor to The Otaka Fabric Company, West Hartford, Conn.—1,676,655.

Process for the Saccharification of Cellulose-Bearing Material. John Perl, Los Angeles, Calif., assignor to M. M. Cory, San Diego, Calif.—1,677,406.

Glass Feeding and Delivering Mechanism and Process. Enoch T. Ferngren, Beaver, Pa., assignor, by mesne assignments, to Hartford-Empire Company, Hartford, Conn.—1,677,436.

Apparatus for Producing Glass Substitute. Adolph Zimmerli, New Brunswick, N. J., assignor, by mesne assignments, to Acetol Products, Inc.—1,677,576.

Sheet-Glass-Producing Apparatus. John L. Drake, Toledo, Ohio, assignor to The Libbey-Owens Sheet Glass Company, Toledo, Ohio.—1,678,060.

Removable-Type Fourdrinier Paper-Making Machine. Earl E. Berry, Beloit, Wis., assignor to Beloit Iron Works.—1,678,176.

Process for the Production of High-Alpha-Cellulose Fiber. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,678,230.

Method and Apparatus for Feeding Molten Glass. George E. Howard, Butler, Pa., assignor, by mesne assignments, to Hartford-Empire Company, Hartford, Conn.—1,678,291.

Process of Purifying Sugar Solutions. Friedrich Wilhelm Meyer, Wismar, Germany.—1,678,571.

Process for Removing Hydrochloric Acid from Sugar Solutions. Fritz Koch, Geneva, Switzerland, assignor to The International Sugar and Alcohol Company, Limited, London, Eng.—1,678,819.

RUBBER, RAYON AND SYNTHETIC PLASTICS

Manufacture of Decorative Plastic. John H. Clewell, Arlington, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,675,642.

Condensation Product of Urea and Formaldehyde and Process of Making Same. Alphonse Gams and Gustave Widmer, Basel, Switzerland, assignors to the Firm: Society of Chemical Industry in Basle, Basel, Switzerland.—1,676,543.

Quality of Sulphur. Carleton Ellis, Montclair, N. J., Composition comprising sulphur and a sulphur-containing resin.—1,676,604.

Cellulose-Ester Composition. Richard L. Kramer, Wilmington, Del., assignor to E. I.

du Pont de Nemours & Company, Wilmington, Del.—1,676,612.

Accelerator, Method of Vulcanizing Caoutchouc, and Product Thereof. Lorin B. Sebrell, Akron, Ohio, assignor to The Good-year Tire & Rubber Company, Akron, Ohio.—1,676,838.

Resinous Composition and Process of Making Same. Victor H. Turkington, Caldwell, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,677,417.

Manufacture of Paraformaldehyde. Karl Sator and Wilhelm Pfannmüller, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfurt-on-the-Main, Germany.—1,677,730.

Cellulose Composition. Otto Drossbach, Ludwigshafen-on-the-Rhine, and Otto Jordan, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfurt-on-the-Main, Germany.—1,677,753.

Spinning Machine for Spinning Artificial Silk. Albert Wagner, Gross-Zschachwitz, near Dresden, Germany, assignor to the Firm: Fr. Küttner, Pirna, Saxony.—1,677,940.

Process for Treating Rubber Latex and Products Obtained Thereby. Omar H. Smith, New York, N. Y., assignor to General Rubber Company, New York, N. Y.—1,678,022.

Process of Producing Vulcanized Rubber. Winfield Scott, Akron, Ohio, assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,678,084-5.

Plastic Composition. Courtney Conover, Crafton, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,678,105.

Process of Producing Light-Colored and Color-Fast, Hard, Infusible, and Insoluble, Products of Condensation of Phenols and Aldehydes. Leonhard Deutsch and Isak Thorn, Vienna, Austria, assignors to The Selden Company, Pittsburgh, Pa.—1,678,107-8.

Plastic Composition and Method of Production Thereof. Oscar A. Cherry and Cletus F. Chosa, Milwaukee, Wis., assignors to The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—1,678,635.

Rubber Softening and Compounding Ingredient. Clayton Olin North, Tallmadge Township, Summit County, Ohio, assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,679,000.

Process for Producing Resin by Polymerization. Wesley Reiff Gerges, Philadelphia, Pa., assignor to The Barrett Company.—1,679,214.

PETROLEUM REFINING AND PRODUCTS

Art of Cracking Hydrocarbons. Edward W. Isom, Winnetka, Ill., and Charles L. Parmelee, Orange, N. J., assignors to Sinclair Refining Company, Chicago, Ill.—1,675,558.

Process of Producing High-Viscous Lubricating Oil and High-Grade Asphalt From Petroleum. Arthur E. Pew, Jr., Bryn Mawr, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,675,462.

Method for Cracking Oils. Charles L. Parmelee, Orange, N. J., and Edward W. Isom, Winnetka, Ill., assignors to Sinclair Refining Company, Chicago, Ill.—1,675,575.

Separating From Fluid Hydrocarbons Other Hydrocarbons Which Precipitate at Low Temperature. Nils Olof Backlund, Stockholm, Sweden, assignor to Bergedorfer Eisenwerk Aktiengesellschaft, Sande, near Bergedorf-Hamburg, Germany.—1,676,069.

Oil Still. Edward W. Isom, Scarsdale, N. Y., and Arnold Charles Vobach, Whiting, Ind., assignors to Sinclair Refining Company, Chicago, Ill.—1,676,202-4.

Process of Treating Oils. Henry C. Kirk, Baltimore, Md.—1,676,230.

Sludge Treatment. Lloyd B. Smith and George W. Jamison, Philadelphia, Pa., assignors to The Atlantic Refining Company, Philadelphia, Pa.—1,676,294.

Art of Distilling Hydrocarbon Oils. Roger D. Hunneman, Chicago, Ill., assignor to Standard Oil Company, Whiting, Ind.—1,676,609-11.

Reclaiming Distillation Residues. Stewart P. Coleman, Cambridge, Mass., and Wayne S. Hughes, Goose Creek, Tex., assignors to Standard Oil Development Company.—1,676,687.

Pyrogenesis of Petroleum Products. Frank A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,676,694.

Art of Distillation. Arman E. Becker, Newark, N. J., assignor to Standard Oil Development Company.—1,676,724.

Process of Treating Oils. Frank A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,676,826-28.

Process and Apparatus for Cracking Petroleum. Lee J. Gary, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,676,895.

Process and Apparatus for Cracking Oil. Robert T. Pollock, New York, N. Y., assignor to Universal Oil Products Company, Chicago, Ill.—1,676,924.

Process for the Refining of Petroleum Fractions. Frank C. Axtell, South Pasadena, Calif., assignor to Axtell Research Laboratories, Inc., Los Angeles, Calif.—1,677,425.

Process of Working Up Acid Resins Obtained From the Refining of Mineral-Oil Derivatives Into Neutral Bitumens. Carl Sautermeister, Wiesbaden, Germany, and Friedrich Wilhelm, Ploesti, Rumania.—1,677,731.

Art of Cracking Hydrocarbons. Eugene C. Herthel and Thomas De Colon Tift, Chicago, Ill., assignors to Sinclair Refining Company, New York, N. Y.—1,677,772-6.

Apparatus for Cooling Oil or Other Liquids. James Moore, Burmah, British India, assignor to The Burmah Oil Company Limited, Glasgow, Scotland, a British Company.—1,678,070.

Process of Transforming Light Paraffin Hydrocarbons into Other Products. Alexander S. Ramage, Detroit, Mich., assignor to Bostaph Engineering Co., Detroit, Mich.—1,678,078.

Process and Apparatus for Cracking Mineral Oil. James M. Schoonmaker, Jr., Sewickley, Pa., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,678,126.

Agitator for Chemically Purifying Oil. Jerry W. Kincade, Lethbridge, Alberta, Canada.—1,678,225.

Process for Refining Oils and Waxes. Walter Albert Patrick, Mount Washington, and Ernest Baldwin Miller, Baltimore, Md., assignors to The Silica Gel Corporation, Baltimore, Md.—1,678,298-9.

Flotation Oil. Gale L. Adams, Huntington Park, Calif., assignor to Standard Oil Development Company.—1,678,311-12.

Process for the Production of Oxidized Products. Rutherford B. Martin, New York, N. Y., assignor to Minerals Separation North American Corporation, New York, N. Y.—1,678,403.

Art of Treating Oil Wells. James B. Garner and George B. Leyden, Pittsburgh, Pa., assignors to Standard Oil Development Company.—1,678,592.

Treating Hydrocarbon Oils. William S. Hadaway, Jr., New Rochelle, N. Y., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,678,728.

Method of Distilling Oil Shale and Providing a Raw Material Suitable for the Manufacture of Hydraulic Cement. Oskar Tetens, Oerlinghausen-Lippe, Germany, assignor to the Firm Record Cement-Industrie G. m. b. H., Frankfort-on-the-Main, Germany.—1,678,751.

Process for Refining Petroleum Oils with Doctor Solution. Robert L. Hallett, Brooklyn, N. Y., assignor to National Lead Company, New York, N. Y.—1,678,984.

Process of Cracking Petroleum Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,679,208.

COAL PROCESSING AND COMBUSTION

Coking Retort Oven. Joseph Becker, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,675,687.

Gas Producer. Charles W. Lummis, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass.—1,678,148.

Pulverized-Fuel Burner. Wilfred R. Wood, London, England, assignor to International Combustion Engineering Corporation, New York, N. Y.—1,676,511.

Coke Oven. Thomas G. Kus, Chicago, Ill., assignor, by mesne assignments, to Chicago Trust Company, trustee, Chicago, Ill.—1,676,736.

Automatic Control for Water-Gas Sets. John Hawley Taussig, Philadelphia, Pa., assignor to The U. G. I. Contracting Company, Philadelphia, Pa.—1,677,102.

Apparatus for Cooling Incandescent Coke. Arnold Moetteli, Oberwinterthur, Switzerland, assignor, by mesne assignments, to Dry Quenching Equipment Corporation, New York, N. Y.—1,677,196.

Gas-Purification Process. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to The Koppers Company.—1,677,304.

Method of Quenching Coke. Frank F. Marquard, Clairton, Pa.—1,677,973.
Briquette and Process of Making the Same. Albert L. Stillman, Plainfield, N. J., assignor to The General Fuel Briquette Corporation, New York, N. Y.—1,677,994.
Apparatus for Carbonization. Charles Burton Winzer, Balham, London England.—1,678,687.

Coking Retort Oven. Joseph Becker, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,678,802.

Coking Retort Oven. Joseph Van Akeren, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,678,803.

Coke-Oven-Door-Operating Apparatus. Heinrich Koppers, Essen-Ruhr, Germany, assignor to The Koppers Development Corporation, Pittsburgh, Pa.—1,678,864.

ORGANIC PROCESSES

Manufacture of Hydrocyanic Acid From Formamide. Paul La Frone Magill and Paul Johnson Carlisle, Niagara Falls, N. Y., assignors to The Roessler & Hasselcher Chemical Co., New York, N. Y.—1,675,366.

Method of Preparing Nitropridine Arsenic Acids. Arthur Binz and Curt R  th, Berlin, Germany.—1,675,402.

Sulphur Dyestuff. Lincoln M. Shafer, Jersey City, N. J., assignor to Tower Manufacturing Co., Inc.—1,675,430.

Dyestuffs Intermediates. Fritz Ballauf, Friedrich Muth, and Albert Schmelzer, Elberfeld, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,675,478.

Sulphur Dyestuffs. Erwin Kramer, Cologne-Deutz, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,675,498-9.

Process of Making Solvent Oil. Satoyasu Iymori and Koji Suzuki, Tokyo, Japan, assignors to Zaidan Hojin Rikagaku Kenkyujo, Tokyo, Japan.—1,675,977.

Process for Making Powdered Vitreous Polymerized Styrol and its Homologues, to the Powder so Produced, and Articles Including Such Material. Iwan Ostromislensky, New York, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,676,281.

Production of Esters of Aromatic Acids. Roger Adams, Urbana, and Ernest H. Volwiler, Chicago, Ill., assignors to The Abbott Laboratories, Chicago, Ill.—1,676,470.

Process of Obtaining Absolute Alcohol. Donald B. Keyes, New York, N. Y., assignor to U. S. Industrial Alcohol Co.—1,676,735.

Resorcinol. Alfred R. L. Dohme, Baltimore, Md., assignor to Sharp & Dohme, Inc., Baltimore, Md.—1,677,116-17.

Process for the Chlorination of Methane. Erich Krause, Constance, Germany, assignor to the Firm: Holzverkohlungs-Industrie Aktiengesellschaft, Constance, Baden, Germany.—1,677,831.

Production of Glycerine by Fermentation. James W. Lawrie, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,678,150.

Manufacture of Methyl Eugenol. William Guy Andrewartha, Sydney, New South Wales, Australia.—1,678,416.

Process of Dyeing With Vat and Azo Dyestuffs. Wilhelm Winterhalder, Frankfurt-on-the-Main, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,678,580.

Method of Making Esters. George Barsky, New York, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,678,719.

Process for the Preparation of Arsenic Compounds. Arthur Binz, Berlin, and Curt R  th, Rangsdorf, Germany.—1,678,760.

Process for Producing Citric Acid by Means of Fermentation. Josef Sz  cs, Vienna, Austria, assignor to Montan- und Industrialwerke vormals Joh. Dav. Starck, Prague, Czechoslovakia.—1,679,186.

INORGANIC PROCESSES

Sulphur-Bearing Article. Harry A. Noyes, Sound Beach, Conn., assignor to Texas Gulf Sulphur Company, Bay City, Tex.—1,675,376.

Phosphate Reducer for Bottom Chrome Dyeing. Neil Neville, Birmingham, Ala., assignor to Federal Phosphorus Company, Birmingham, Ala., a Corporation of Alabama.—1,675,459.

Process of Making Sodium Hydrosulphide. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,675,491.

Process for the Production of Carbonates. Max Buchner, Hanover-Kleefeld, Germany, assignor to Albert Fritz Meyerhofer, Zurich, Switzerland.—1,675,786.

Alloy and Process for Making Same. Russell Franks, Brooklyn, and Burnham E. Field, Douglaston, N. Y., assignors to Haynes Stellite Company.—1,675,798.

Process for the Preparation of Sodium Phosphate. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,676,556.

Process for the Manufacture of Arsenic Acid. Fritz Ullmann, Charlottenburg, and Gert Trewendt, Berlin, Germany, assignors to J. Michael & Co., Berlin, Germany.—1,677,257.

Treatment of Magnesium and Magnesium Alloys to Inhibit Corrosion. Arthur C. Zimmerman, Dayton, Ohio.—1,677,667.

Copper Chromium Ferrous Alloys. Byramji D. Saklatwalla, Crafton, Pa.—1,676,929.

Production of Alkali-Metal Compounds From Silicates Containing Them. Thomas A. Edison, Llewellyn Park, N. J., assignor to Thomas A. Edison, Incorporated, West Orange, N. J.—1,678,246.

Process of Manufacturing White Acetate of Lead Solutions or Crystals Out of Pyro-ligneous Acid. Max Klar, Holzminde, Germany.—1,678,256.

Production of Commercial Borax From Na₂O.2B₂O₃.4H₂O. Thomas M. Cramer, Long Beach, Calif., assignor to Pacific Coast Borax Company.—1,678,381.

Process of Making a Mixture of Nitrogen and Hydrogen. Franz Georg Liljenroth, Stockund, Sweden.—1,678,518.

Metallurgy of Zinc. James A. Singmaster, Bronxville, N. Y., and Frank G. Breyer and Earl H. Bunce, Palmerton, Pa., assignors to The New Jersey Zinc Company, New York, N. Y.—1,678,607.

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10 cents to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices being given on application.

Process of Recovering Combined Nitrogen from Crude Calcium Cyanamide. Guy H. Buchanan, Westfield, and Palmer W. Griffith, Elizabeth, N. J., assignors to American Cyanamid Company, New York, N. Y.—1,678,721.

Process of Making Alkali-Metal Hydroxides. Leo P. Curtin, Freehold, N. J.—1,678,767.

Hypochlorite Composition. James Douglas MacMahon, Niagara Falls, N. Y., assignor to The Mathieson Alkali Works, New York, N. Y.—1,678,987.

CHEMICAL ENGINEERING PROCESSES

Process for the Production of Carbon Electrodes. Imre Szarvasy, Budapest, Hungary.—1,675,674.

Fractional Condensation of Mixed Vapors. Louis Weisberg, Grantwood, N. J., assignor to The Barrett Company.—1,676,232.

Dehydrating Alcohol and the Like. Warren K. Lewis, Newton, Mass., assignor to Standard Oil Development Company.—1,676,700.

Method of Manufacturing Cements Rich in Alumina. Alexander Hasselbach, Dessau, Germany, assignor to G. Polysius, Dessau, Germany.—1,677,182.

Process of Mixing Metallic Salt in Asphaltic Compounds. Francis L. Carson, Berkeley, Calif.—1,677,272.

Absorption Plant for Gases and Vapors. Fritz Rottmann and Friedrich Brohmeyer, Bovinghausen, Germany.—1,677,409.

Process for Producing in a Solution the Crystallization of the Body Dissolved Therein. Albert Delas, Paris, France, assignor to Soci  t   des Condenseurs Delas, a Corporation of France.—1,667,551.

Revivifying of Spent Decolorizing Materials. Oscar L. Barnebey, Columbus, Ohio.—1,677,947.

Means for Washing or Dyeing Material. Julius Brenzinger, Fairfield, Conn., assignor to The Max Ams Chemical Engineering Corporation, Bridgeport, Conn.—1,678,053.

Process of Reviving Catalysts. Alphons O. Jaeger, Hamburg, N. Y., assignor to The Selden Company, Pittsburgh, Pa.—1,678,626-7.

Purification of Liquids. George Charles Lewis, New Dorp, N. Y., assignor to Darco Sales Corporation, New York, N. Y.—1,678,676.

Process of and Apparatus for Treating Water. George Cawley, Montclair, N. J., assignor to The Permutit Company, New York, N. Y.—1,678,766.

Process of and Apparatus for the Treatment of Solid-Bearing Liquids. Walter L. Remick, New York, N. Y.—1,678,788.

Process of Tanning Hides. Kurt H. Meyer and Hermann Sch  tte, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfurt-on-the-Main, Germany.—1,678,998.

APPARATUS AND EQUIPMENT

Beating Engine. Leo Shlick, Boston, Mass.—1,675,385.

Apparatus for Boiling or Raising the Temperature of Water and Other Liquids. Cecil Featherstone Hammond and William Shackleton, London, England.—1,675,347.

Rotary Kiln and Cooler. Porl T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smith & Co., New York, N. Y.—1,675,416.

Grinding-Mill Screen. William Frederick McMahon, Riverside, Calif.—1,675,417.

Shredder-Type Pulverizing Hammer. William M. Pryor, St. Louis, Mo., assignor to Southern Manganese Steel Company, St. Louis, Mo.—1,675,464.

Grinding Mill. John Mursch, Utica, N. Y., assignor, by direct and mesne assignments, to Buffalo Hammer Mill Corporation, Buffalo, N. Y.—1,675,658.

Welding Medium for Aluminum. Wilhelm Reuss, Mannheim, Germany.—1,675,664.

Mixing Machine. Leslie W. Claybourn, Milwaukee, Wis.—1,675,694.

Electric Welding Machine. Le Roy H. Hoffer, Brooklyn, N. Y., assignor to Thomas E. Murray, Brooklyn, N. Y.—1,675,705.

Drying Apparatus for Rotary Kilns. Fritz Luther, Dessau, Germany, assignor to G. Polysius, Dessau, Germany.—1,675,717.

Electrode Holder for Electric Furnaces. Ferdinand Weckerle, Munich, Germany, assignor to Studiengesellschaft fuer Wirtschaft u. Industrie m. b. H., Munich, Germany.—1,675,742.

Shaft-Type Electric Furnace. Thaddeus F. Bailly, Alliance, Ohio.—1,675,744.

Grease-Melting Furnace. William C. Loyd and Arthur R. McArthur, Gary, Ind., assignors to American Sheet and Tin Plate Company, Pittsburgh, Pa.—1,675,813.

Apparatus for Softening Water. August Neumann, Reppen, Germany, assignor, by mesne assignments, to The Permutit Company, New York, N. Y.—1,675,860.

Disintegrating Machine. Philip S. Mitts and William J. Winston, Saginaw, Mich., assignors to Mitts & Merrill, Saginaw, Mich.—1,675,901.

Liquefaction Apparatus. Richard C. Tolman, Washington, D. C.; William L. De Baufre, Lincoln, Nebr.; John W. Davis, Washington, D. C.; and Montague H. Roberts, Englewood, N. J., assignors to Samuel G. Allen, trustee.—1,676,225.

Pressure and Vacuum Filter. Gaston Joel Lipscomb, Montclair, N. J.—1,676,268.

Cooling Apparatus. Russell W. Mumford, Trona, Calif., assignor, by mesne assignments, to American Potash & Chemical Corporation, New York, N. Y.—1,676,277.

Device for Separating Liquid from Solid Material. Sten V. C. Plate, Chicago, Ill.—1,676,459.

Grinding Apparatus. Charles H. Norton, Plainville, Conn., assignor, by mesne assignments, to Cincinnati Grinders Incorporated, Cincinnati, Ohio.—1,676,620.

Apparatus for Conveying Pulverized Material. Alonzo G. Kinyon, Allentown, Pa., assignor, by mesne assignments, to James W. Fuller, Catasauqua, Pa.—1,677,119.

Heat-Interchange Device. Cecil Robert Houseman, Wembley, England, assignor, by mesne assignments, to Air Reduction Company, Inc.—1,677,777.

Water-Softening Apparatus. Walter H. Green, Chicago, Ill., assignor to General Zeolite Company, Chicago, Ill.—1,677,891.

Evaporating Apparatus. Ermin Pokorny, Prague, Czechoslovakia.—1,677,987.

Combined Mill, Conveyor, Drier, and Classifier. Walter Duisenberg, Los Gatos, and John H. Macartney, San Francisco, Calif.—1,678,002.

Sublimator. Frank A. Pearl, New York, N. Y.—1,678,442.

Refrigeration. Joseph L. Schlitt and Walcott Dennis, Elizabeth, N. J., assignors to Air Reduction Company, Incorporated, New York, N. Y.—1,678,485.

Scraper for Rotary Filters. Albert L. Genter, Salt Lake City, Utah, assignor to United Filters Corporation, New York, N. Y.—1,678,639.

Solar-Heat Drier. Lewis H. Shipman, Boston, Mass.—1,678,711.

Apparatus for Carrying Out Chemical Reactions Between Gases or Vapors, or Gases and Vapors. Hans Harter, Wurzberg, Germany.—1,678,778.

Boiler Composition and Method of Making Same. Hans Karplus, Frankfurt-on-the-Main, and Wilhelm Bachmann, Seelze, near Hanover, Germany, assignors to Firm E. de Haen A.-G., Seelze, near Hanover, Germany.—1,679,037.

NEWS of the Industry

Chemical Industry Featured at Safety Congress

CHEMICAL industry is to have an important part in the annual Congress of the National Safety Council which will be held in New York October 1 to 5. Preliminary plans announced by C. F. Whittemore of the Western Electric Company, and Chairman of the Program Committee for the Chemical Section indicate that a number of well known speakers will be available to discuss all phases of safety affecting chemical operations.

At the luncheon meeting on Monday, October 1, H. C. Parmelee, editor of *Chemical & Metallurgical Engineering* is to speak on the subject of "Some Recent Observations on Safety in Chemical Engineering." In the subsequent afternoon session John F. Shaw of the Hercules Powder Company is to be chairman of the round table discussion on "Safety in Chemical Industries."

Beginning at 9:30 on the second day, the Chemical Section is to hear a paper by Dr. Frank Underhill of Yale Medical School, entitled "Treatment of Chemical Burns." This will be followed by a paper on the "Toxicity of Solvents and Diluents in the Paint Industry." A general discussion of health hazards in the chemical industry will then be presented from three viewpoints. Dr. C. T. Graham-Rogers, Assistant Director of the New York Bureau will present the subject from the Labor Department's viewpoint. Dr. G. H. Gehrmann of the du Pont Company continues the discussion from the viewpoint of industry while a third speaker, Walter Paine, chief engineer of the Aetna Life Insurance Company will discuss chemical health hazards from the viewpoint of the underwriter.

A discussion of the "Status of Chemical Industry as Revealed by Accident Experience" will open the program on Wednesday. The subject is to be presented by A. L. Armstrong of the Eastman Kodak Company and C. F. Coffelt of the Victor Chemical Works of Chicago Heights, Ill. Professor Yandell Henderson of Yale University will discuss the subject of gas masks and respirators. The session will be concluded with three 10-minute talks on "Safe Handling of Compressed Gases."

"Safety in Chemical Equipment" is to be treated in the session that starts

on Thursday, October 5 at 9:30. At present three divisions of the subject are under consideration: 1—Pressure Release Methods, 2—Corrosion and Maintenance and 3—Gaging and Sampling. J. H. Shapleigh of the Hercules Powder Company is to discuss the third division. Stanley H. Kershaw, formerly of the Hercules Powder Company and now an executive of the National Safety Council in its offices at 108 East Ohio Street, Chicago, Ill., is co-operating with Mr. Whittemore in the final organization of the program for the Chemical Section.

Union Carbide Takes Over Acheson Graphite

ANNOUNCEMENT was made last month that Union Carbide & Carbon Corp. has made an agreement under which it will acquire all the common stock of Acheson Graphite Corp. in exchange for shares of its own stock. All holders of the common stock have signed this agreement and the exchange will probably take place within the next thirty days.

Management and policies of Acheson Graphite Corp. will, in the main, continue as heretofore. Acheson Smith, president of Acheson Graphite Corp., is to remain as president and Dr. Edward G. Acheson, the inventor and founder of the company, will be chairman of the board.

Ice Substitute Developed in Germany

THERE has recently been developed in Germany a new process for the construction of skating rinks using a floor prepared from chemicals rather than with ice. Although this process is new, it has already been tried out commercially, and the installations to date have been moderately successful, it is claimed.

According to James E. Wallis, trade commissioner, the chemical composition used appears to be soda ash with certain other chemicals added to prevent its solution in water. The ordinary material as it appears on the floor of the rink has the appearance of an almost opaque dirty ice, or may more accurately be described as having the appearance of crude rock salt as it comes from the mines.

Symposium on Corrosion at T.A.P.P.I. Fall Meeting

THE Technical Association of the Pulp and Paper Industry will hold its fall meeting at Wausau, Wis., September 25-27. The program includes presentation of the following papers: "Manufacture of Cellulose Products from Corn Stalks" by E. F. Hulbert; "Improving Paper Drying Efficiency by Atmospheric Control" by R. Skagerberg; "A New Paper Machine Drier Design" by F. C. Farnsworth; "Technical Control in Board Mills" by E. F. Whittington; "Application of Meters to Pulp and Paper Mills" by R. V. Knapp; "Ultimate Structure of Wood Cells" by Dr. George Ritter; "Production of Commercial Newsprint from Hard Woods" by C. E. Curran; "Pulping Eastern Hemlock by the Sulphite Process" by H. W. Monsson; "Economic Factors of Utilizing Seed Flax Straw" by C. C. Heritage; "Effect of Bleach Ratio and Agitation on Bleaching of Sulphite Pulp" by P. K. Baird; "Pulp Analyses" by M. W. Bray; "Alkaline Pulp Mill Control" by C. K. Textor.

There will also be a symposium on the general subject of corrosion and waste under the direction of Dr. H. L. Joachim of the Container Corporation of America. Participating in this program will be L. F. Warrick, L. M. Booth, A. T. Gardner, E. R. Schafer, and R. M. True.

An interesting event during the meeting will be the presentation of the association gold medal to W. H. Mason and Ogden Minton. Mr. Mason developed the explosion process for utilizing waste wood for wall board, and Ogden Minton is the inventor and developer of the vacuum paper machine. In addition to the program of technical papers, a considerable amount of time will be devoted to visiting local paper mills and the recreational program includes a series of luncheons and banquets as well as outdoor activities.

Ethylene Glycol Duty Free

A report from Commercial Attaché L. W. Meekins, Ottawa, dated July 13, stated that an Order in Council of June 29, designates ethylene glycol, when for use in the manufacture of Canadian products, as tariff item 788 and specifies that it is to be free of duty from June 29 until the end of the next session of Parliament.

Institute of Chemistry Attracts Prominent Scientists

Contributions of Science To Industry
Outlined at Evanston Meetings

SIR JAMES M. BARRIE once dished scientists a back-handed compliment when he said that they were the only people in the world who had anything to say—but didn't know how to say it. Had he been around Evanston, Ill., during the four weeks of the Institute of Chemistry of the American Chemical Society held during July and August at Northwestern University, he would have changed his mind. For chemists, from the world over, had their say—clearly and forcibly. As a result even the lay public has been able to grasp the wide spread advances which science has made towards world progress recently.

Chemistry will solve the farm problem by utilizing waste products, millions will be salvaged in form of cellulose, furfural and their products. G. M. Rommel of the Department of Agriculture; Professor O. R. Sweeney of Iowa State College; H. G. Knight of the Bureau of Chemistry, Dr. R. W. Thatcher, president of Massachusetts Agricultural College and Dr. Umberto Pomilio of Naples, Italy, told how.

Although it was predicted thirty years ago that the world would be suffering from a nitrogen famine, science has made such advances in production of synthetic nitrogen, there may eventually be an over-supply according to Professor Harry A. Curtis of Yale, who returned recently from the International Nitrogen Conference held on board the S.S. *Lützow* in the Adriatic Sea.

Never will the world have to worry about food supplies, for when the need comes, "the chemist will convert the light of the sun and the nitrogen of the air into supplies for the human family," declared Dr. H. E. Barnard of Indianapolis, "Thirty men working in a factory the size of a city block can produce in the forms of yeast as much food as 1,000 men tilling 57,000 acres under ordinary agricultural conditions."

Dr. C. H. Herty, former president of the American Chemical Society and now advisor to the Chemical Foundation, told how science is wrestling with the problem of finding some utilization for the 60,000,000 tons of lignin, which composes half of wood, and is now a total waste.

SYNTHETIC rubber isn't feasible yet, declared Thomas Midgley, Jr. of Dayton, Ohio. It is too hard to beat nature—when natural resources are so abundant. But inhibitors and anti-oxidants have made the life of rubber four-fold, explained Dr. W. L. Semon of the B. F. Goodrich Company.

Professor Whitmore, head of the Northwestern Chemistry Department, and director of the Chemical Society

Institute, told how chemists, working with things they cannot see, have changed poisons into perfumes, dyes and valuable drugs—all by harnessing the atom.

Bunkless chemistry came in for a few words when Professor W. T. Read of Texas Technological College pointed out that attainments in applied chemistry are not the results of black magic or a sublimated hocus-pocus.

Dr. Paul Nicholas Leech of the American Medical Association carried the point further when he raked chemical quackery over the coals. "The street faker," he said, "who sells a so-called silver plating preparation for the housewives' worn knives and forks, consisting essentially of mercury, is perpetrating an out and out fraud. For mercury does not silver plate and soon evaporates; but even worse, such propaganda—going on uncontrolled on the streets of our big cities today—is a source of potential health hazard. Even more harmful are some of the copper cleaners sold to restaurants. They do clean and shine the copper utensils, but there are some which contain one of the most poisonous ingredients known—cyanide."

If the benefits of scientific investigation are to be fully realized, a federal board of research under centralized control soon will have to be formed, declared Dean Gerald L. Wendt, of Pennsylvania State College.

Appropos of this, came a brilliant lecture by Sir James C. Irvine acting chancellor of St. Andrew's University, Scotland, and an eminent authority on hydrocarbons. He pointed out how Great Britain has become "father of research" in its country by subsidizing young students of merit and keeping them in the universities instead of allowing them to be attracted to industry.

Dr. Gustav Egloff, Chicago chemist, said that 3,000,000,000 gal. of gas and more than \$400,000,000 could be saved annually if auto companies would increase the compression of their machines. The cracking process in petroleum technique now perfected to an exact science, brought about the conservation of 450,000,000 bbl. of crude oil—or four and a half billion gallons of gas.

A. S. Richardson of the Proctor and Gamble Company of Ivorydale, Ohio, told of the wonders of hydrogenation—by which cheap cotton seed oils are transformed into hard fats by merely shooting hydrogen through them in the presence of nickel.

Dr. J. G. Lipman of the New Jersey Agricultural Experiment Station told how colbalt and nickel are now being used in a diabetic cure.

Professor Ellice McDonald of the University of Pennsylvania Medical

School, said that science is on the eve of making some remarkable announcement on cancer research—having discovered a close relation between the composition of the blood and inclinations towards the disease.

Others pointed out the hazards to health in certain occupations—chromium plating coming in for a jolt from William Blum of the U. S. Bureau of Standards, who urged greater protection to workers in the industry.

Japan Will Subsidize Soda Ash Industry

THE Japanese Ministry of Commerce and Industry has decided to subsidize the soda ash industry, because of its importance as one of the basic industries of the country, according to the United States Department of Commerce. The subsidy will amount to 2,500,000 yen, running for five years, and will be given starting from the next fiscal year. As to the method of subsidization the ministry will give a certain amount of bounty to the purchaser of industrial salt in order to place the Japanese manufacturing companies in the same position as foreign companies and thus offset the advantage now enjoyed by the manufacturers of other countries through the use of tax-free salt.

The South Manchuria Railway Company is now seeking land near Dairen and Port Arthur to erect a factory for the soda ash industry with an initial investment of 5,500,000 yen. It is planned to make use of the large supplies of salt available in the leased territory of Kwantung. The new company, which will be operated as an affiliated company of the South Manchuria Railway Company, feels that it will be able to undersell the Japanese product on the Japanese market. The company has applied to the Ministry of Commerce and Industry for sanction of its project.

Transportation Regulations To Be Modified

THE Interstate Commerce Commission has announced that unless objection be filed with the commission indicating that proposed modifications are unreasonable the commission intends to modify certain of the regulations for the transportation of explosives and other dangerous articles. Among the proposed changes announced are those affecting the method of packing dynamite; increase in maximum weight of charcoal screenings in cars over 36 ft. 6 in. long; increase in quantity and higher loading densities for anhydrous ammonia and liquefied petroleum gases; new tank car specifications 105A400, 105A500, and 105A600 prescribed; weight of express shipments of pyroxilin plastics increased; extension for one year from November 1, 1928, of test period for special fiber board of pulp-board cases for matches.

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

DEVELOPMENTS in connection with the suits brought by the Department of Justice against the German and French potash producers and the Kina Bureau of the Dutch reveal that the European business man fails to grasp the purport of our anti-trust statutes. European countries have come to regard cartels and monopolies as in the public interest and as the ideals to attain the maximum of efficiency. In Italy the government is taking drastic steps to force centralization in business. It seems to be as difficult for them to comprehend why there may not be extensive co-operation among producers of the same commodity as it is for them to understand our prohibition law.

The French are outraged as a result of the suit. Since the production of potash is a government operation, they feel that the national honor has been encroached upon. Their attitude is that the state can do no wrong and as a consequence they have refused to sign the consent decree, as this would imply some wrongdoing on the part of a government bureau. To take refuge behind such an abstract thing as national honor, however, is recognized as a French tendency, whether it involves differences as to the Olympic games, differences as to tariff, or objections by this government to business practices by foreign interests operating in the United States which are denied American concerns.

THE Germans come no closer to a realization of the American viewpoint, but there the potash industry is in the hands of practical business men, instead of bureau chiefs. As a result they are anxious to settle the matter and avoid what is certain to be a spectacular legal proceeding that will not redound to the good of their industry, even if it should escape penalties. The attitude of the French, however, makes it seem likely that the Department of Justice will have to go ahead with the suit so as to bring them to a realization that a government engaged in business operations must assume the liabilities of private enterprise. Bureau chiefs, however, have nothing to lose as a result of litigation and it is not held in disfavor, as is the case with the German business men who are responsible for the conduct of the potash industry in that country.

The negotiations in connection with the potash suit, however, have brought out new evidence that it is not the German idea to run up the price, but instead to sell potash at a low price with the idea of expanding its use. The Germans also apparently have

abandoned any thought of holding a club over the United States by threatening to withhold shipments. They realize that there are various places in the world where potash is available and while the securing of its requirements elsewhere would cost the United States very dearly, they doubtless believe that nothing would be gained by threats.

The Kina bureau, true to Dutch traditions, is reluctant to depart from its policy of giving too little and asking too much. The representatives of the bureau have been particularly arbitrary and hard to convince in connection with the charges of conspiracy and restraint of trade, but apparently they have seen the light and while the proposed agreement has not been signed at this writing, there is every reason to believe that they are going to sign on the dotted line.

THESE suits have had the effect of calling to the attention of American business that the anti-trust statutes can be used on behalf of American business as well as against it. It is recognized that this procedure may be applied to rayon, asbestos and to the foreign monopoly situation generally. They also have emphasized that the United States is entangled in the international cartel movement. While this is largely on the financial side, there nevertheless are close working agreements between foreign cartels and American manufacturers. It already is a matter of public knowledge that a large New York bank has had an important part in the financing of the Imperial Chemical Industries, Ltd. There is a close relationship between another large American bank and a German cartel. Negotiations are said to be in progress at this time between the French chemical interests and another important financial house in this country. Italy still has a considerable task before it in centralizing its chemical industry, but all agree that this will be accomplished eventually. When that day arrives the chances all are that a part of the financing will be done in this country.

In this connection it may be said that observers in Washington expect to see a sharp upturn in the establishment of American plants by foreign chemical manufacturers. The Germans have gone so far as to decide that they will not attempt to maintain control in these plants. Apparently they are ready to allow Americans to purchase 75 or 80 per cent of the stock in such enterprises.

The new movement to establish plants in the United States probably

will await the results of the presidential election, but foreign manufacturers apparently are very generally of the opinion that a high tariff is to be maintained by this country.

THE report that the Imperial Chemical Industries has completed negotiations for the acquisition of the Welsbach Light company has been confirmed by the Board of Directors of the light company, according to information received by the Commerce Department. The acquisition would be effected on the basis of exchange of imperial Chemical Industries shares whereby the control of the light company would pass to the chemical organization. The offer will be withdrawn if not accepted by the holders of at least 76 per cent of the Welsbach shares before August 14. The board of the light company, however, is urging its share holders to accept the offer and the indications are that a sufficient number will signify their approval to permit the transaction to be carried through.

As the result of a three years' study of the use of "dry ice" in the United States, a Swedish company has announced that it will start the manufacture of the product in Sweden, according to reports received by the Commerce Department. This Swedish company will produce the "dry ice" from the liquid carbonic acid at present produced in its plant. At present, it is estimated that the new dry ice can be sold in 20 kilogram pieces at what amounts to sixty cents in Swedish currency per piece. Natural ice is now sold to large consumers in Sweden at the equivalent of thirteen cents per twenty kilogram piece. The Swedish company in back of this venture realizes that the initial production of solidified carbon dioxide will be small. It is hoped, however, that the demand will increase to a sufficient extent to make possible cheaper production.

ADVICES received by the Commerce Department from Berlin indicate that the German industry in order to stimulate the sale of synthetic calcium nitrate, will furnish 100 kilo special bags free of charge to the buyers. Based on the present prices of such bags, for which the customer was forced to pay in previous years, this new policy actually brings down the price of calcium nitrate by the amount of eight penning per kilo of primary nitrogen.

The German Institute for Research on Business Conditions estimates the possible increase in the use of nitrogen fertilizer in that country at 28 kilograms of effective nitrogen per hectare, the Commerce Department has been informed. It is calculated that this increase would result in an additional 2,000,000 tons of grain crops. During the crop year of 1926-1927, German agricultural engineers have found that maximum intensity in the use of nitrogen fertilizers was reached only in a few cases.

Stabilization of Franc Aids French Export Trade

French Government Votes Credit To Overcome Shortage of Low-Rental Houses

From Our Paris Correspondent

OFFICIAL stabilization of the franc at 65.5 milligrams, gold, has been the most important recent development in French affairs. This rate of exchange was reached about eighteen months ago and has been maintained since then. The significance of the official action is found in the fact that fluctuations are now made impossible. This gives an opportunity to maintain trade with the many new markets, outside the country, which were opened up after the war and which probably would be lost if the franc rose in value. The recent slight loss in export trade has not affected the general prosperity of the country as the decline is more than counterbalanced by receipts of foreign money brought in by tourists.

Prospects in the chemical, metallurgical and textile industries are good and their present situation is favorable, judging by their balance sheets. Unemployment is insignificant, labor being so scarce in a few specialized trades, such as mines or chemical products' works, that foreign labor is needed. The devastated war areas are now almost completely restored and the housing problem will now have to be dealt with as it is a strong drawback to the national prosperity.

At present the government is keeping down the prices of rents, which are only double of what they were before the war, whereas prices of building and repairing are five times higher than pre-war levels owing to the decrease of the franc. Therefore in order to obviate any further complications the Chambers of Parliament voted a credit of 11 billion francs for the building of low-rental houses. These houses, however, will not be built before 1929.

THE second international peat congress was held at Laon in the Aisne, July 8-12. Mr. Gabriloff, a Russian chemist, delivered a lecture on the research made at the Moscow Peat Institute; another Russian, Mr. Radtenko, then said that several electrical central works in Russia used peat as fuel. It is not probable France will follow this lead, though her coal mines cannot supply all her home wants. In France the use of imported coal will always be more remunerative, both in heat and power production, than the use of home-made peat.

The following application of peat is the only interesting case worth mentioning: Peat, after being granulated, carbonized and distilled after the Charles Roux process used by the Notre-Dame-de-Liesse's works, yields peat granules which are used as fuel in gazogenes for motor-lorries and motor-tractors. On the contrary lignites give favorable re-

sults when treated by the Salerni-oven (French patent No. 547,344). This oven has been tested with lignites from Manosque, also sorted Sarre schists. Good results have been obtained, the only drawback being the inclusion of dust in the condensed products.

The Salerni-oven is an apparatus for the carbonization at low temperature, an oven which for this reason interests all French manufacturers and engineers. Low temperature carbonization, however, yields a most brittle coke whose use and sale are difficult. In spite of this the Mining Company of Vicoigne, Noeux and Drocourt has succeeded in producing it advantageously after long and arduous researches.

WITHOUT giving away manufacturing secrets or entering into technical details we may say that different sorts of selected coals are pulverized and then briquetted by the use of appropriate binders such as pitch, asphaltum, sulfite of cellulose, etc. The briquettes are then put into a kind of large converter and steam, coming at a temperature of about 600 to 650 deg., C., from an appropriate superheater, is injected at the base. The converters form a battery arranged in such a manner that the heating fluid circulates according to a closed cycle. By consecutive elimination of the converters the last agglomerates are treated at the highest temperature available.

Besides the main products obtained in this fashion, the byproducts yielded are compact small lumps of artificial coal known under the name of "anthracine" frequently used in central heating boilers, a notable economy as nearly all anthracite used in such cases is imported coal either from Belgium or Great Britain.

The industrial heating congress was held in Paris from June 20-July 10. It included an exhibition of all kinds of industrial heating apparatus using either solid, liquid or gaseous combustibles. Among the resolutions adopted by the congress were: that the present research made by the Société de Physique Industrielle on the combustion temperature of carbon should be completed and similar research made on other combustibles; that new and more precise determination tables on specific heats of gases be evolved; that combustibles should be bought under conditions uniformly adopted and methods of analysis and trials should be standardized; that consumers of benzol should be supplied with a standardized product, and that a more liberal and clearer fiscal taxation should be made; that the difference existing between the ignition and burning point

of fuel-oils should be reduced to a minimum, the last named point corresponding to the average composition of the fuel-oil and indicating its thermic power.

Canadian Newsprint Trade in Depression

PRACTICAL dissolution of the Canadian Newsprint Company, which was organized a little more than a year and a half ago, has had a depressing effect upon the newsprint industry throughout. While in existence, this company exercised a stabilizing effect on sales prices, the withdrawal, though, of large factors from the company practically created an open market and prices suffered as a consequence. Recent reports say that overproduction in the newsprint industry continues, and despite efforts in Canada to find a remedy nothing definite has resulted. Most hopeful development is the fact that officials of the provinces of Quebec and Ontario have been conferring in the hope of evolving a plan to ameliorate present conditions.

Chief difficulty in the newsprint industry is that production of newsprint plants must closely adhere to demand. Storing of newsprint is expensive, owing to the difficulty of keeping it from being damaged. Also a mill producing 300 or 400 tons of newsprint a day has not the space to store its production of even a few days. Thus mills are often forced to sell their product for the best price obtainable when production of the industry as a whole outstrips consumption, as at present.

Individual companies are meeting present conditions with varying degrees of success. There has been some curtailment of production, but this has been largely offset by increase of production at low-cost mills.

Chemists Urged To Curtail Use of Benzol

RECOMMENDATION that use of benzol in chemical laboratories be reduced to a minimum, because of the hazard of poisoning, is made by Assistant Physical Chemist J. J. Bloomfield, of the United States Public Health Service. The report which was issued on July 31 states that the hazard attending the use of benzol in industry has been well established in the recent studies conducted by the United States Public Health Service in co-operation with the National Safety Council. As a result of these studies it was concluded that "The use of benzol (except in inclosed mechanical systems), even when the workers are protected by the most complete and effective systems of exhaust ventilation, keeping the average concentration of benzol in the work-room air below 100 parts per million, involves a substantial hazard. Every possible effort should, therefore, be made to develop the use of substitute solvents of a less toxic nature wherever this is possible.

Tartaric Acid Discussed at Public Hearing

TARTARIC acid was the subject of a public hearing before the Tariff Commission on July 25. Cost studies for 1925 made by the commission's staff showed that the weighted average production costs in the United States were \$0.2665 per lb. f.o.b. plant, while the combined German and Italian costs were \$0.1981 per lb. f.o.b. plant, justifying an increase in the present duty of 6c. per lb.

At the hearing representatives of domestic producers said that it was wrong to include German costs since Italy is the principal competing country and that Italian costs are about three-fourths of the German costs. They figured the true 1925 costs to be 22c. per lb. in Germany and 15 or 16c. per lb. in Italy. Since 1925, domestic costs have increased 25 per cent, the commission was told.

Charges were made that German manufacturers had instructed their agents in this country to undersell the domestic product. William Newburg of New York, agent for several foreign companies, stated in his testimony that he had never received any instructions to undersell the domestic product. He explained that he had received price lists from his employers with instruction to follow its quotations.

C. P. Teeter of New York, who testified for the domestic interests, said that recently he had visited several European countries investigating the costs of producing tartaric acid there compared with the costs of producing it here. He asserted he found that the wages of the European workman averaged only one-third of the American workman's wages. He also alleged that foreign cartels had been formed in Europe to restrict the production and control the prices.

Several representatives of American companies testified to the effect that all had noted losses in their business due to the inability of their factories to manufacture tartaric acid at such a low cost as to be able to compete with the imported material.

J. L. Warner of New York, testified he had bought 500,000 lb. of tartaric acid of German manufacture together with 500,000 lb. of domestic manufacture, although he said he had to pay 1½c. per lb. more for the foreign than American. He explained that he purchased the foreign commodity because they guaranteed a special valuation which the domestic did not. He stated that the German product sold for 33½c. per lb., including the 6c. a lb. tariff while the domestic product sold for 32c. per lb.

The hearings were closed with his testimony and the commission granted the counsels until August 6 to exchange briefs and until September 17 in which to file them.

William M. Williams, former Commissioner of the Internal Revenue, acted as counsel for the importers. The companies which are asking for an increased

tariff are the Royal Baking Powder Co., and Charles Pfizer & Co., of New York, the Harshaw-Fuller-Goodwin Co., Cleveland, and the American Cream of Tartar Co. of San Francisco.

Opportunity was also given by the commission for any who may desire to voice their opposition to the proposal for an increase in the tariff on cream of tartar to present written views thereon prior to the time of the filing of the brief of the proponents on September 17.

Cornstarch Has Wide Use in Industry

THE cornstarch industry has developed very rapidly in recent years, production having increased from 311,100,000 lb. in 1904 to a high record of 933,242,065 pounds in 1927, according to a statement by Felix D. Pope, Foodstuffs Division, Department of Commerce.

The starch industry of the United States ground 85,653,509 bu. of corn in 1927; this is approximately 20 per cent of all the so-called "cash" corn; that is, corn that actually comes into the market. It is well known that the great bulk of our corn crop, averaging about 2,850,000,000 bu., never leaves the farm, only about 450,000,000 bu. finding its way into commercial channels.

Commercial cornstarch goes into many different industries and finds many uses, the textile industry being the largest user in this country and the amount sold by grocers for food and home laundry purposes being second. The 93,242,065 lb. produced in 1927 were distributed among the various trades as follows:

Bakers, bakers' supply, flour mills and mixers	23,591,162
Baking powder manufacturers ..	48,651,820
Brewers (refined grits)	4,142,320
Confectioners and confectioners' supply	32,649,575
Chemists, color manufacturers, and explosives	29,580,076
Dealers and repackers (bulk) ..	41,664,117
Dextrine makers and foundries ..	79,380,726
Paper, paper box, paste, bill-board, and asbestos	71,621,043
Grocers (packages)	134,713,807
Laundry (bulk to laundry trade) ..	15,176,603
Cotton mills and other textiles ..	150,531,468
Miscellaneous	45,107,844
Export	256,331,504

Fertilizer Conference at West Baden

INVITATIONS to attend the second national fertilizer conference at West Baden, Ind., September 5 and 6, are being sent to farm paper editors, fertilizer manufacturers, State and Federal officials and others interested. Dr. Tait Butler, editor of the *Progressive Farmer*, Memphis, is chairman of a committee of arrangements which was appointed at the conference held in Louisville last fall. The conference will discuss problems common to the producer and user of fertilizer and will take up such matters as standardization, nomenclature, concentrations, and related problems.

Holding Company for Near East Oil Interests

THE Near East Development Corp. has been organized in Delaware as a holding company with \$5,000,000 capital to take over the 23½ per cent interest jointly held by five American oil companies in the Turkish Petroleum Co. The latter unit is developing Mosul oil concession obtained from the Iraq government.

Turkish Petroleum is controlled by an international group of oil interests, each owning 23½ per cent of the stock. These interests are Anglo-Persian Oil Co., Royal Dutch, a French group, and the American companies. C. S. Gulbenkian, who obtained the original concession from the old Turkish regime prior to the World War, has 5 per cent interest.

Originally the concession was largely held by German interests, but the property was taken over by alien property custodians of the Allies and when Iraq was made a British mandate after the war the interest in Turkish Petroleum was apportioned among the various national oil interests.

The American companies jointly owning the 23½ per cent interest in Turkish Petroleum are Atlantic Refining, Pan American Petroleum, Gulf Oil, S. O. of New Jersey and S. O. of New York.

Officers of the Near East Development Co. are: President, W. C. Teagle; vice-president, C. S. Davison; treasurer, H. E. Cole. These, with W. M. Irish and R. G. Stewart comprise the board of directors.

U. S. Consumes 30 Per Cent of Mercury Production

LEADING producers of mercury, Italy and Spain, accounted for more than 80 per cent of the United States imports during the first six months of 1928, according to a report from the Minerals Division, Department of Commerce. The report says the manufacture of various mercurial salts and preparations accounts for a major portion of the mercury consumed in the United States. Of secondary importance is the consumption of the metal in scientific instruments, electrical equipment, and power generation.

The production of mercury in the United States is not sufficient to satisfy domestic demands, and therefore American consumers are obliged to purchase abroad the major part of their required supply. This country annually consumes over 30 per cent of the world output of quicksilver, and it ranks first among the eight more important industrial nations of the world as a consumer of the metal.

Italy is the leading producer of mercury, a preliminary estimate of the Italian Ministry of National Economy showing that in 1927 that country's output was 58,761 flasks of 75 lb., compared with 50,000 flasks by Spain, as shown by Spanish figures, 11,276 flasks by the United States and 2,396 flasks by Mexico.

News in Brief

THE ADDITION OF a nitrogen plant to their iron and steel works in IJmuiden, Netherlands, by the Koninklijke Nederlandsche Hoogovens en Staalfabriek, will constitute the first factory for the manufacture of artificial nitrates in that country, according to a report from Consul Pattie H. Field at Amsterdam.

THE AWARDED OF a general contract for the erection of the buildings and other structures for the government's new helium production plant near Amarillo, Texas, has been announced by the Bureau of Mines which will have supervision over the project. The time for completion of the plant called for under the contract is seventy-five days. Helium-bearing natural gas for the plant will be furnished, under a contract between the Amarillo Oil Company and the government, from the Cliffside structure lying to the northwest of Amarillo.

THE TARIFF COMMISSION has ordered an investigation of the cost of production of barium chloride. According to information available at the commission's offices, Germany is the principal source of barium chloride. Imports of the product in 1927 were over 3,000,000 lb.

THAT MASS PRODUCTION is insecure for both labor and capital because of its dependence upon wide markets, and that social research and scientific management under the joint auspices of labor and employers are needed to give stability to industry and to protect wage earners against those effects of mechanization which are detrimental, was pointed out by speakers from the United States, Great Britain, Germany and other countries at the Congress of the International Industrial Relations Association which recently completed five days' discussion of the subject, Fundamental Human Relationships in Industry, at Cambridge, England.

ECONOMISTS AND COST accountants have been designated by the United States Tariff Commission to make a cost survey of the American blown glass tableware industry. The survey is being made by the commission in connection with an application for increased tariff rates on imported blown glass tableware from Europe.

INDICATIONS ARE THAT more than 2,000 chemists and scientists will attend the Fall meeting of the American Chemical Society Sept. 10 to 15, at Swampscott, Mass. The members of the Northeastern Section will be hosts to the society. Both the scientific and entertainment programs will be of the highest order. There will be papers by international authorities. There will be trips to Marblehead, Salem, Gloucester, Lexington, Concord, Sudbury, and other

places of historic and present-day interest.

A symposium on nitrogen will include the following papers: The New Place of Nitrogen in Chemical Economics, by Jasper E. Crane, president, Lazote, Inc.; Synthetic Ammonia, by E. M. Allen, president, Mathieson Alkali Works; Economic Relationships Between Nitrogen and Fertilizers, by H. R. Bates, manager Manufacturing Dept., International Agricultural Corp.; Byproduct Nitrogen, by Charles J. Ramsburgh, vice-president, The Koppers Co.; The International Nitrogen Problem, by Dr. Walter S. Landis, vice-president, American Cyanamid Co.

IT IS REPORTED that Mayor Raleigh P. Hale of East Chicago, Ind., has given orders that no building permit be issued to U. S. Gypsum Co. to erect a \$2,500,000 plant in that city. Company recently paid \$160,000 for the site on which plant was to be built. It was said the plant would emit a fine dust that would be a nuisance.

THE GERMAN-OWNED "San Pedro" plant is installing new machinery for the manufacture of nitrate of soda under the "Banthien" process, which was developed in the German potash industry and recommended by the head of the research bureau of the Nitrate Producers' Association as adaptable to the Chilean industry. The patent rights of this new process for Chile have been purchased by German interests and a separate company has been formed for its development.

Yugo-Slavia Prominent in Chilean Nitrate

NEARLY one-third of Chile's nitrate plants are controlled by Yugo-Slav interests, a report from Consul R. R. Bradford, Iquique, reveals. British companies rank second constituting a little over 18 per cent of the total industry, followed by British-Chilean, with 9.2 per cent, Chilean with 8.5 per cent, Spanish with 7.2 per cent and German with 5.2 per cent. Less than 5 per cent of the 152 plants producing nitrates are now under American control.

Attention is called by Consul Bradford to the fact that the percentages given apply solely to ownership of the various plants and have no reference to production by the plants controlled by the several nationalities.

Window Glass Hearing Set for September 11

Public hearings in the window glass investigation which the Tariff Commission originally set for August 7 were postponed until August 21. At the beginning of the month it was announced that interested parties had sought a later date for the hearing and this resulted in a further postponement with September 11 as the date agreed upon.

Twelve Topics Picked for Coal Conference

TWELVE major topics for discussion at the Second International Conference on Bituminous Coal to be held under the auspices of the Carnegie Institute of Technology, Pittsburgh, Pa., November 19-24, 1928, are tentatively announced by Dr. Thomas S. Baker, president of the institution, and chairman of the Congress. About one hundred engineers and scientists representing fifteen nations have already tentatively accepted invitations to speak or to send papers to the Congress, and the number of speakers and delegates is growing daily. About sixty per cent of the papers will be delivered by representatives of foreign countries.

Although the Second International Conference will be similar in purpose to the first Congress held in 1926, preliminary plans for this year's meeting show that its scope will be considerably enlarged and the program will be more important and more international in character. The discussion of Fixed Nitrogen is one of the topics which will receive close attention. The liquefaction of coal, which was one of the principal subjects of discussion at the first meeting, will again occupy a prominent place in the deliberations. Low temperature distillation will be treated by representatives of at least a half dozen countries. High temperature distillation, power from coal, coal tars and oils, complete gasification of coal, origin of coal, coal washing, pulverized coal, catalysts, and the general aspects of the bituminous coal industry are other topics that will be considered.

Chile Limits Free Entry for Nitrate Bags

RECENT legislation by the Chilean government provides that in the future only such nitrate bags may be entered free of duty as are imported by the Nitrate Producers' Association of Chile and that the Producers Association must prove that the bags intended for importation were purchased from a manufacturer, were transported under freight contracts entered into by the association, and will be distributed by this group to users. On contracts entered into prior to the date of this decree, purchasers may receive their goods by transferring their contracts to the association and receiving their bags through that institution, with the approval of the Superintendency of Nitrates and Mines.

Ralph E. Ackerman, commercial attaché at Santiago, in commenting on this ruling states it is obvious that by conferring upon the Nitrate Producers Association the sole right to import, nitrate concerns not in this combine could be seriously affected. The reason given for these restrictions is that under the previous law, instances arose where bags not intended for nitrate users were imported free.

Chemical Investigation of Smelter Fumes

CHEMICAL and pathological studies of the effect of sulphur fumes on vegetation will be undertaken as a result of the preliminary survey of areas in Columbia River Valley, State of Washington, alleged to have been damaged by fumes from the smelter at Trail, British Columbia. This investigation was made by Dr. W. W. Skinner, Assistant Chief, Chemical and Technological Research, Bureau of Chemistry and Soils; A. T. Strahorn, Associate Soil Scientist, Bureau of Chemistry and Soils; and D. F. Fisher, Pathologist, Bureau of Plant Industry, its purpose being to determine the character of the injury to the vegetation and to form some idea as to the lines of investigation to follow and the number of men needed in the field. Conferences were held at Spokane with Senator C. C. Dill, of Washington, and Dr. Edward C. Johnson, Dean of the College of Agriculture of Washington, with representatives of farm groups and with officials of the smelter company.

As a result of the report the Bureau of Chemistry and Soils will undertake chemical examination of the fumes from the smelter and will study the effect of the fumes upon vegetation and upon the soil. An economic survey to determine the value of the area now affected by the smelter operations has already been started by Mr. Strahorn. Within the near future the Bureau of Plant Industry will send into the affected area a forest pathologist to ascertain the extent of the damage to the timber.

New Chemical Enterprise for Esthonia

A NEW chemical company with the title "Amylderivat" has recently been formed in Reval for the purpose of manufacturing oils and chemical products exclusively from domestic raw materials. One of the main products will be oil of cade, for which a large demand exists from the leather industry and supplies of which have been very short for some years. The company will also produce wood pitch, methyl alcohol and acetone from wood waste and will work up the fusel oil derived from Esthonian distilleries into amyl alcohol, amyl acetate, butyl acetate and wood preserving agents.

Poison Sought to Combat Codling Moth

THE Bureau of Chemistry and Soils, in co-operation with other bureaus of the department, has definitely joined the American apple and pear grower in his warfare against the destructive armies of the codling moth by establishing field laboratories at Wenatchee and Yakima, Wash., where it is hoped to develop a poison that will be superior to the lead-arsenate spray which at present is the only effective method with which to combat this serious pest.

C. R. Gross, an associate chemist of the Bureau of Chemistry and Soils, will take charge of the chemical investigations at Wenatchee and Yakima, where he will co-operate with Dr. L. A. Hawkins and H. C. Diehl, of the fruit-handling division, and Dr. Charles Brooks and D. F. Fisher, of the fruit-disease division of the Bureau of Plant Industry, and with E. J. Newcomber, of the Bureau of Entomology, in the effort to help apple orchardists to solve a three-fold problem by creating a poison deadly to codling moths, harmless to humans, and which will not require a wash or other treatment that will shorten the life of the apple when in storage.

Sodium Carbonate Subject to Import Duty

Overruling an import claim of J. T. Steep & Company, Inc., of Seattle, the United States Customs Court on August 7 decided that imported hydrated sodium carbonate is not duty free under paragraph 1619 of the Tariff Act of 1922. The collector's assessment at one-half cent per pound under paragraph 83 was upheld.

U. of P. Gets Smith Chemical Memorabilia

THE valuable collection of chemical memorabilia assembled by the late Dr. Edgar Fahs Smith, who was internationally known as a chemist and was Provost of the University of Pennsylvania for ten years, has been presented to the University by his widow, Mrs. Margie A. Smith, and will be preserved intact in its present setting in the Harrison Chemical Laboratory, it was announced at the University today.

With the acquisition of the collection which will be known as "The Edgar Fahs Smith Memorial Collection in Historical Chemistry" the University is making special arrangements to safeguard it, following which it will con-

CALENDAR

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, convention, New York City, Dec. 27, 1928-Jan. 2, 1929.

AMERICAN CHEMICAL SOCIETY, 76th meeting, Swampscott, Mass., Sept. 10-14.

AMERICAN ELECTROCHEMICAL SOCIETY, fall meeting, Charleston - Huntington, W. Va., Sept. 20-22.

AMERICAN GAS ASSOCIATION, 10th annual convention and exhibition, Atlantic City, Oct. 8-12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, tour, with British Institution of Chemical Engineers, Quebec, Shawinigan Falls, Montreal, Ottawa, Kirkland Lake, Port Colborne, Niagara Falls, Akron, Pittsburgh, Wilmington, Edgewood, Washington, and New York, August 18-Sept. 2.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, petroleum division, meeting, Tulsa, Okla., October 18-19.

AMERICAN SOCIETY FOR STEEL TREATING, annual convention, Philadelphia, October 8-12.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, regional meetings, St. Paul-Minneapolis, Aug. 27-30, Boston, Oct. 1-3. Fuels division, second national meeting, Cleveland, Sept. 17-20.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL, 2nd conference. Carnegie Institute of Technology, Pittsburgh, Nov. 19-24.

NATIONAL METAL WEEK, Philadelphia, Oct. 8-12.

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRIES, fall meeting, Wausau, Wis., September 25-27.

tinue to be accessible to visitors and students of the history of chemistry, many of whom during Dr. Smith's lifetime had frequent recourse to it for study and research work. Eventually, it is expected, the University will create a fund, the interest of which will be devoted to the perpetual maintenance of the collection, and additions will be made to the collection from time to time.



Chemical Memorabilia of the late Dr. Edgar Fahs Smith

MEN

in Chemical Engineering

WILLIS WASHBURN, assistant manager of the St. Louis plant of the Titanium Pigment Company, has sailed for Germany to act as adviser to the I. G. Farbenindustrie in the installation of its large new factory for titanium salt production. Under an agreement last year of the I. G. and National Lead Company concerning titanium processes Mr. Washburn was loaned for this service, which he will carry on at the Titangesellschaft, Leverkusen.

PHILIP G. MUMFORD has resigned as president of the Commercial Solvents Corporation to become a partner in the banking firm of William Schall and Company. The resignation takes effect on September 1.

E. F. ARMSTRONG, late managing director of the British Dyestuffs Corporation, has resigned his post as manager of the Corporation under Imperial Chemical Industries, Ltd.

A. FRUMKIN, professor of the Karpov Institute of Chemistry of Moscow, will join the University of Wisconsin in September as visiting professor of colloid chemistry.

A. R. MARTIN, for many years refinery superintendent of the Huasteca Petroleum Company and the Mexican Petroleum Company, has now joined C. F. Brown & Company for whom he will specialize in the design of refinery units.

DOUGLAS E. PRICE, formerly with the contracting department of the Koppers Construction Company, has transferred to the American Tar Products Company as contract manager.

WALDO L. SCOVILLE, assistant state analyst of the Michigan State Department of Agriculture for the past six years, is now with the P. J. Ritter Company at Bridgeton, N. J.

A. J. STAMM, colloid chemist on the staff of the United States Forest Products Laboratory, Madison, Wis., left for Europe on leave of absence on July 15. Availing himself of an International Education Board fellowship he will work under Prof. Svedburg at Upsala on cotton and wood cellulose.

GEORGE FILLMORE SWAIN, faculty member of the Harvard Engineering School since 1909, has received the first award of the Benjamin G. Lamme gold medal "for accomplishment in technical teaching or actual advancement of the art of technical training." Dr. Swain is a graduate of M.I.T. where he began his teaching career in 1887.

F. C. YOKEL recently became plant superintendent in charge of phosphate and fertilizer plants for the Myles Salt Company, Ltd., New Orleans.

JOSEPH BECKER has been appointed vice-president and general manager of The Koppers Construction Company after being for some time vice-president and consulting engineer of that organization. Mr. Becker is well known as the inventor of the "Becker" oven; he has spent twenty-five years in the by-product coking industry, having started



JOSEPH BECKER

in the laboratories of Dr. Koppers in Essen. He came to this country with Dr. Koppers in 1910 and has been associated with every installation of Koppers ovens in the United States and Canada.

L. W. RYAN has recently been made director of research of the new research laboratory of the Titanium Pigment Co., Inc., Brooklyn, N. Y. He had formerly been engaged in general research work for the company at Niagara Falls, N. Y.

E. C. BAIN has resigned from his position as a research metallurgist of the Union Carbide and Carbon Research Laboratories at Long Island City to accept a position in the newly established research laboratories of the U. S. Steel Corporation. He undertook his work in the new connection under Dr. John Johnston during July.

W. E. GRIFFITHS has become associated with the Duraloy Company of Pittsburgh as metallurgical engineer. Mr. Griffiths is a graduate of Ohio State University and for a number of years has been a research metallurgist with the Union Carbide and Carbon Research Laboratories at Long Island City.

TRELL W. YOCUM, who after a career as editor became associated with the oil industries, has become managing director of the Oil Heating Institute and American Oil Burner Association.

DONALD MACARTHUR, vice-president of the Seaboard By-Product Coke Company, has in addition received supervision of the Philadelphia Coke Company, which has a new coke plant under construction. On the managerial staff there will also be W. H. Earle, R. L. Spatz, and Fred Denig, all of the Koppers Construction Company.

WILLIAM D. TICKNOR, chairman of the board of Commercial Solvents Corporation, has been appointed president as successor to Philip G. Mumford. He had already occupied this post from the time of the company's organization to 1922.

ROBERT B. SOSMAN, who has been for many years on the staff of the Geophysical Laboratory, Carnegie Institution of Washington, has resigned to join the staff of the U. S. Steel Corporation's department of research and technology.

C. E. PLUMMER has resigned from the Union Carbide and Carbon Research Laboratories to take up special work in the analytical and metallographic divisions of the Pittsburgh Testing Laboratories.

OBITUARY

RUFUS C. PHILLIPS, secretary of the American Rolling Mill Company, died at his home in Middletown, Ohio, on July 11, at the age of 63, following several weeks of illness. Mr. Phillips was a co-founder, with George M. Verity, of the firm in 1891.

HANS FOERSTERLING, widely known retired chemist, committed suicide at his home on Abor Farm, Jamesburg, N. Y., on August 8 by swallowing poison.

Coming from Germany 57 years ago, Dr. Foersterling established the chemical plant of Roessler and Hasslacher at Perth Amboy and guided the organization as president and chief chemist. When the plant was taken over by the Government during the World War, he retired and in seclusion devoted himself to chemical experimenting. His place of residence, Abor Farm, received its name from the legend "Agriculture Based on Research."

RALPH A. GOULD, consulting chemical engineer of San Francisco, California, died in Pasadena on July 12th. He was only 52 years of age but had already suffered from heart trouble for some time. Mr. Gould was a graduate of the University of California. Before entering the consulting field he was chief of the Food and Drug Inspection Laboratory of the Bureau of Chemistry in San Francisco.

FREDERICK W. GRIFFITH, president and treasurer of the Garlock Packing Company, died on July 11 at his home in Pasadena, Calif., in his 70th year. Mr. Griffith was a graduate of Hamilton College, later became a New York State senator and was a founder of his company some 40 years ago.

MARKET CONDITIONS and PRICE TRENDS

Industrial Demand for Turpentine Increased Last Year

Steady Gain Also Reported in Consumption
of Mineral Thinners

INDUSTRIAL concerns, which use turpentine in their products, increased their demands for the latter in 1927 as compared with the preceding year. The

tion of this production by states is not yet known. This information will be given in the forthcoming report of the Bureau of the Census, as well as sta-

Table 1—Industrial Consumption of Turpentine and Rosin During 1927 and 1926¹

Industry	1927			1926		
	Turpen- tine, Gal.	Rosin, 500-Lb. Bbl.	Mineral Thinners, Gal.	Turpen- tine, Gal.	Rosin, 500-Lb. Bbl.	Mineral Thinners, Gal.
Paper and paper size	3,651	297,426		6,956	325,312	
Soap	1,575	200,454	167,502	5,373	236,514	166,231
Paint and varnish	4,701,166	228,776	55,524,831	4,428,447	219,530	51,112,008
Shoe polish	599,669	905	10	534,079	1,078	300
Printing ink	15,060	14,553	429,418 ²	12,572	14,161	97,942
Oils and greases	113,407	56,613	42,160	180,871	57,752	34,312
Sealing wax, pitch, insulations and plastics	59,234	38,674	257,045	66,291	51,500	130,181
Match		2,965			2,815	
Linoleum	3,250	37,586	1,763,267 ²	5,524	44,357	126,834
Chemicals and pharmaceuticals	24,205	8,462		29,061	5,201	
Automobiles and wagons	242,022	1,029	794,238	280,385	907	866,921
Foundries and foundry supplies	21,684	16,907	161,817	16,179	21,052	64,020
Shipyards	15,847	90	27,010	16,042	102	26,290
Miscellaneous	37,528	2,511	1,462	35,069	3,804	12,700
	5,838,298	906,951	59,168,760	5,617,049	984,085	52,637,739

¹ Consumption data are for calendar years. Other data herein given are for the fiscal year of the naval stores industry, ending on March 31. In most industries a few concerns did not report after repeated requests. To cover these, estimates were made to make the figures reported herewith as nearly correct as possible. These estimated quantities are less than 5 per cent of the total.

² Increase due in part to the fact that certain firms reported use of mineral oil thinners during 1927 that did not report on these previously.

Table 2—Production of Turpentine, Rosin and Pine Oil by Classes

Class	1927-28			1926-27		
	Turpentine, Gal.	Rosin, Rd. Bbl.	Pine Oil, Gal.	Turpentine, Gal.	Rosin, Rd. Bbl.	Pine Oil, Gal.
Gum products ¹	32,500,000	2,165,000		25,500,000	1,700,000	
Team-solvent process ²	3,847,389	409,474	2,784,042	3,514,915	265,480	2,607,711
Dist. Dist. process				468,140		88,170
Reclaimed rosin					40,000 (estimate)	
				29,483,055	2,105,480	2,695,831

¹ Figures for gum products for 1926-27 and 1927-28 are those published as trade estimates by the Savannah Naval Stores Review. Statistics for 1927-28, being compiled by the Bureau of the Census, not yet available.

² Figures on steam solvent products compiled by J. E. Lockwood, Hercules Powder Company, Wilmington, Delaware.

³ Statistics for 1927-28, being compiled by the Bureau of the Census, not yet available.

Bureau of Chemistry and Soils in reviewing industrial consumption of naval stores, accounts for a disappearance of 5,838,298 gal. of turpentine as compared with 5,617,049 gal. in 1926. Increased industrial consumption also was reported for mineral thinners. The latter includes v.m. and p naphtha which has a well-defined outlet in paint and varnish manufacture and also takes into account, the consumption of thinners produced from a mineral oil base and which more or less come into direct competition with spirits of turpentine.

Statistics are not yet available on production of gum turpentine and gum rosin for the 1927-28 season, ending March 31, 1928. Trade estimates, as published in the *Savannah Naval Stores Review*, indicate a production of approximately 650,000 casks of turpentine, equivalent to 32,500,000 gal., and 2,165,000 round bbl. of rosin. The distribu-

tistics on production of destructively distilled wood turpentine and pine oil.

The quantity of this latter class of turpentine produced is relatively small.

Figures are not available, covering stocks of turpentine on hand on March 31—the close of the naval stores year—at gum turpentine stills. At steam district plants there was held 543,114 gal. as compared with 347,627 gal. in the preceding year. At southern primary ports were 2,568,030 gal. on March 31, 1928, and 1,585,683 gal. on March 31, 1927. Distributing points on March 31 held stocks of 1,319,785 gal. and 700,216 gal. in 1928 and 1927 respectively. At industrial concerns, stocks for the two years were 1,367,883 gal. and 1,058,412 gal.

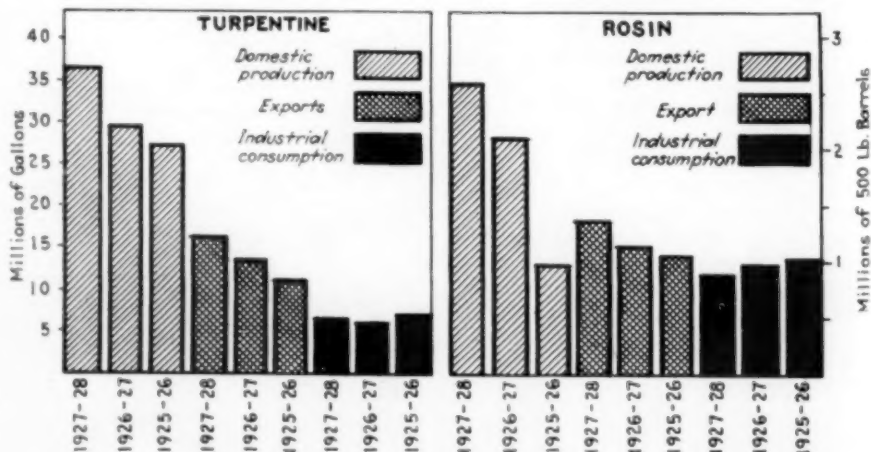
Rosin stocks also were higher at the close of last season. At southern primary ports, 172,391 bbl. was on hand, compared with 125,556 bbl. on March 31, 1927. Distributing points held 24,333 bbl. against 14,081 bbl. and stocks at industrial plants amounted to 211,905 bbl. and 147,442 bbl. respectively.

Our foreign trade in turpentine and rosin during the twelve months corresponding to the naval stores season ending March 31, 1928, showed a satisfactory condition. Exports of turpentine were greater than in any season since 1913-14. Imports of turpentine were slightly greater, while imports of rosin showed a sharp decline, as compared with the last two years. The figures are shown in the following table:

Table 4—Exports and Imports of Turpentine and Rosin*

Season	Turpentine		Rosin	
	Exports, Gal.	Imports, Gal.	Exports 500-Lb. Bbl.	Imports 500-Lb. Bbl.
1927-28	16,494,551	316,348	1,373,411	3,625
1926-27	12,794,850	306,586	1,129,614	22,767
1925-26	11,361,500	287,379	1,083,131	17,068

*All figures are for twelve-month period ending March 31, except those for Imports, 1925-26, which are for Government fiscal year ending June 30, 1926. Figures supplied by the Bureau of Foreign and Domestic Commerce, Department of Commerce.



Production and Industrial Consumption of Turpentine and Rosin

MARKET APPRAISAL OF CHEMICAL INDUSTRY

Palmolive Peet Declares Stock Dividend

DECLARATION of 32½ per cent stock dividend on the common stock of Palmolive Peet Co. has been announced, incident to completion of merger of that company and Colgate & Co. Dividend is payable to stock of record August 10. Directors elected A. W. Peet chairman of executive committee of new company, which will be known as Colgate Palmolive Co. Other members of the committee are Charles S. Pearce, who will be president; N. N. Dalton, vice-president; Felix Lowy, vice-president in charge of sales and advertising; Robert B. Colgate, W. E. McCaw and S. Bayard Colgate. Russell Colgate was elected chairman of finance committee, which also will include A. J. Lansing and J. H. Botz. Sidney M. Colgate will be chairman of the board.

Mathieson Alkali Increases Net Earnings

MATHIESON ALKALI WORKS, Inc., for quarter ended June 30, 1928, reports net income of \$556,666 after depreciation, depletion, federal taxes, etc., equivalent after allowing for dividends on 7 per cent preferred stock, to \$3.49 a share earned on 147,207 shares of no-par common stock. This compares with \$429,463 or \$2.62 a share in preceding quarter and \$452,429 or \$2.78 a share in second quarter of 1927.

Net income for six months ended June 30 totaled \$986,130 after above charges, equal to \$6.11 a share on common against \$898,698 or \$5.51 a share in first half of preceding year.

Texas Gulf Sulphur Shows Higher Income

TEXAS GULF SULPHUR CO., Inc., reports, for quarter ended June 30, 1928, net income of \$3,586,819, after depreciation and federal taxes but before depletion, equivalent to \$1.41 a share earned on 2,540,000 shares of no-par stock. This compares with \$3,087,839, or \$1.21 a share, in preceding quarter, and \$3,262,277, or \$1.28 a share, in second quarter of 1927.

Net income for the first six months of 1928 totaled \$6,674,658, after above charges, equal to \$2.62 a share, against \$6,116,908, or \$2.40 a share, in first half of preceding year.

Commercial Solvents Report

Net profit of the Commercial Solvents Corporation for the first six months of 1928, amounted to \$1,201,240 after charges, equal to \$5.51 a share on 217,722 shares of stock against \$1,215,022 or \$11.16 a share on 108,861 shares of Class B stock in first half of 1927.

Price Range Since Jan. 1	Stock	Price Range for Month		
		July 7	High	Low
197½	Aluminum Co.	150	150	132
74½	Air Reduction	66	68½	62½
14½	Ajax Rubber Co.	8	9	8
184	Allied Chemical	172½	179½	165½
127½	Allied Chemical, pf.	120½	126	120½
23½	Am. Ag. Chemical	19½	20½	18½
75	Am. Ag. Chemical, pf.	67½	71½	65½
53½	American Cyanamid, B.	42½	43½	30½
15½	Am. Hide & Leather	11	11	10
118½	American Linseed	109½	112½	103½
130½	American Linseed, pf.	120½	121	120
51	American Metals	49½	50½	47
24	Am. Rayon Products	21½	22½	17
28½	Am. Solvents & Chemical	22½	22½	20
54	Anglo-Chile Nitrate	45	45½	40½
97	Archer-Daniels-Midland	83	84½	77½
32½	Aes. Dyeing & Printing	30½	30½	27½
101	Atlas Powder	74	80	74
20½	Beacon Oil	16½	18½	14½
83½	Beechnut Packing	74	76½	70½
78½	Bon Ami A.	72½	73½	68½
77½	Bristol-Myers	68	77½	67½
32½	Calif. Petroleum	31½	31½	29
103	Celanese Corp.	78½	78½	67½
185½	Celanese Corp, pf.	143	146½	129
63½	Certainteed	43½	46½	40½
56½	Chickasha Cot. Oil	50½	56½	47
189½	Commercial Solvents, B.	151	158½	144
82½	Corn Products	73	79½	69½
57½	Davison Chemical	52	57	47½
61	Devos & Reynolds	51½	53	49
120	Devos & Reynolds, pf.	115½	115½	112
405½	Du Pont	382½	391½	360
121½	Du Pont 6 pe. db.	116½	117½	114
194½	Eastman Kodak	178	194½	178
238	Firestone Fire	175	175	172
17½	Fisk Rubber	12½	12½	10½
76½	Fleischmann	71	72½	68
109½	Freeport Texas	72	72½	55
26½	Glidden	23	23½	21½
104½	Glidden, pf.	100	101	100
105½	Gold Dust	89	91½	83
99½	Goodrich Co.	76	78	72
167	Houston Oil	139½	141½	127½
84½	Humble Oil	79	83½	76½
97	Industrial Rayon	97	97	78½
20½	Int. Ag. Chemical	17½	17½	15½
80½	Int. Ag. Chemical, pf.	78½	79½	77
86½	International Paper	74	74	66½
69	International Sal.	60	60	52½
27½	Kelley-Springfield	21½	22½	18½
24½	Lee Rubber & Tire	20½	20½	18½
54½	Lehn & Fink	52½	54½	48
140	Libby-Owens	130	140	125
77½	Liquid Carbonic	67½	72½	66½
137½	Mathieson Alkali	125	131	119½
60½	Monsanto Chemical	60	60	55
58½	Natl. Dist. Products	36	45½	33½
147½	National Lead	120½	123	115
260	New Jersey Zinc	218½	225	215
68½	Ohio Oil	62½	64½	61½
95½	Owens Bottle	79½	81½	76½
123½	Palmolive Peet	119	122	110½
44½	Phillips Petroleum	38½	40½	36½
255	Pittsburgh Pl. Glass	245	255	228
61½	Pratt & Lambert	54	56½	53½
300	Proctor & Gamble	282	282	257
27½	Pure Oil	22½	23½	22
79½	Sherwin-Williams	79	82	79
29	Silica Gel	22½	25½	22½
30½	Sinclair Oil	24½	28½	23½
34	Skelly Oil	30½	32½	29½
63½	Standard Oil, Calif.	58½	59½	56½
49	Standard Oil, N. J.	44½	45½	42½
41½	Standard Oil, N. Y.	35½	35½	33½
7½	Standard Pl. Glass	4½	4½	3½
50½	Sun Oil	43	50½	42½
23½	Swan & Finch	21	22½	19½
16½	Tenn. Copper & Chemical	13½	15½	13½
66½	Texas Corp.	61½	63½	58½
80½	Texas Gulf Sulphur	70½	71½	65½
27½	Tidewater Oil	17½	26½	17½
630	Tubize Silk	574	574	475
167½	Union Carbide	149½	160½	142½
57	Union Oil, Calif.	53	53½	49½
95	United Piece Dye	79	80	70
122½	U. S. Ind. Alcohol	110½	112	105½
51	U. S. Leather	43	49½	42
63½	U. S. Rubber	29½	33½	29
87½	Vacuum Oil	76½	81½	74½
96	Vanadium Corp.	76	76½	68½
74½	Vick Chemical	70	70½	67
16½	Va. Ca. Chemical	14½	14½	12½
62½	Va. Ca. Chemical, pf.	50	55½	49
85½	Wesson Oil	79½	79½	74
16	Wilson & Co.	13	14	12½

ECONOMIC INFLUENCES

on production and consumption of CHEMICALS

Larger Production of Chemicals in First Half of Year

Activities in Consuming Industries Absorbed Larger Amounts of Raw Materials

WITH THE exception of some of the wood distillation chemicals, definite figures for production of chemicals this year are not available. Statistics showing activities in some of the industries which are large consumers of chemicals, have been compiled for the first six months of the year and form a basis for estimating consumption of chemicals. These statistics point to a larger production and consumption of chemicals than in the first half of 1927. Fertilizer chemicals are shown in an especially favorable light as the movement of mixed fertilizers was considerably in excess of that reported for the corresponding period of last year. Reports from the leather trade state that sole leather tanners, by producing nearly 8,000,000 backs, bends and sides in the six-months period, exceeded the first half of last year by not quite 1 per cent. The demand for sole was so great that stocks were reduced nearly 6 per cent, from 2,406,000 to 2,264,000 pieces.

Calf tanners in the half-year produced 7,560,000 skins as compared with 7,104,000, an increase of more than 6 per cent. Their stocks dropped from 3,403,000 to 3,139,000 skins.

Sheep shoe leather production increased about 12.5 per cent and stocks were reduced one-fourth. Glove leather

production showed about the same proportionate increase, although stocks were not reduced. The output of shearlings increased from 1,191,000 skins to 1,430,000 skins and deliveries were so heavy that tanners' stocks already small, were nearly halved.

BUILDING operations for the six-month period were on a larger scale than last year and this must have a direct reflection on pigments, chemicals, solvents, etc., which enter into paint and varnish manufacture. Automobile production gave further stimulus to demand for those commodities and the gain in output of tires indicates a larger consumption of chemicals in that quarter. Plate glass shared in the improvement for the period and glass containers also were turned out in greater volume. Petroleum refining, based on run to stills, was nearly 5 per cent higher than in the first half of 1927.

On the other hand the textile industry operated on a lower scale than last year and undoubtedly curtailed its consumption of chemicals. Manufacturers of explosives and chemical wood pulp were less active than was the case last year.

While a review of activities in chemical-consuming industries, therefore, discloses spotted conditions, the greater

number of large consumers are found to have improved their status over that of the first half of 1927 and thus furnish evidence that production and consumption of chemicals in this country have registered gains for the year to date.

In the accompanying table will be found figures which trace production in specified industries through the six-month period with comparisons for the corresponding months of 1927.

ACCORDING to the indexes of the Department of Commerce mineral production was smaller than in either prior period, while the output of manufactures, after adjustment for seasonal variation, showed a slight decline from May but was higher than in June, 1927, the indexes of both minerals and manufactures being those of the Federal Reserve Board.

According to the revised index, stocks of commodities were lower than at the end of May but higher than a year ago. Compared with the preceding month the decline in the general index was due to smaller holdings of raw materials, stocks of manufactured goods showing a slight increase over May. Contrasted with June of last year, stocks of both raw materials and manufactured goods were held in larger quantities.

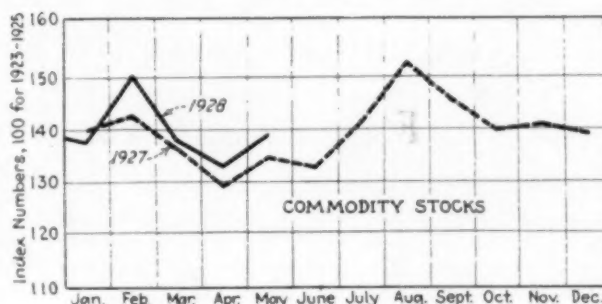
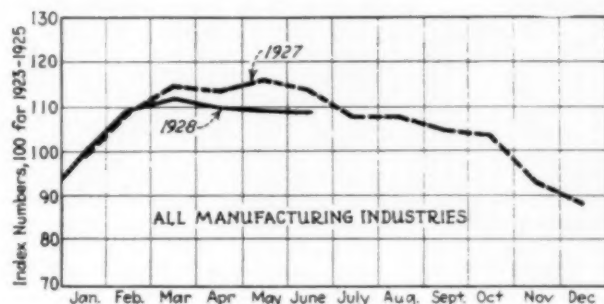
Unfilled orders for manufactured commodities at the end of June were higher than at the end of either the preceding month or June, 1927, the gains over both periods being due to larger forward business on the books of iron and steel manufacturers and lumber mills.

PRODUCTIVE ACTIVITIES IN THE CHEMICAL AND CHEMICAL CONSUMING INDUSTRIES
JANUARY-JUNE, 1927-1928

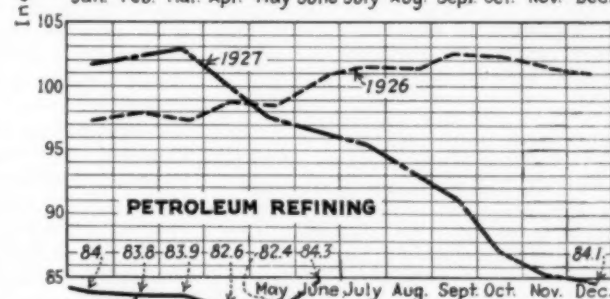
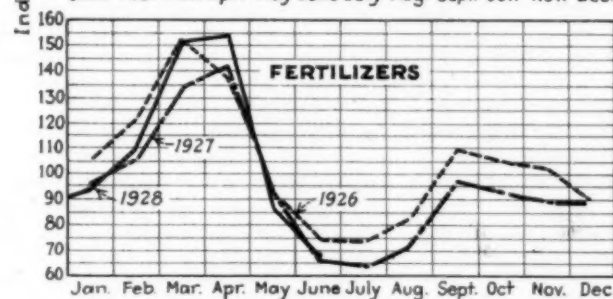
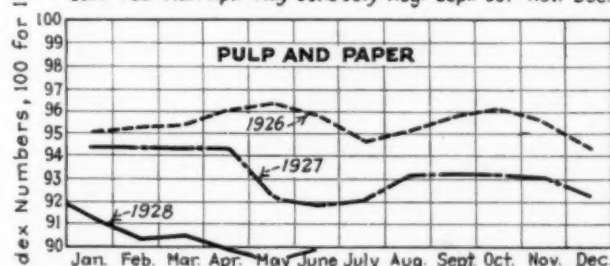
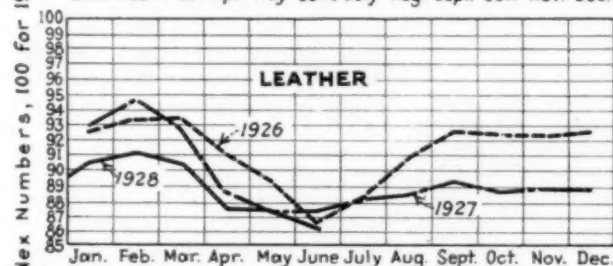
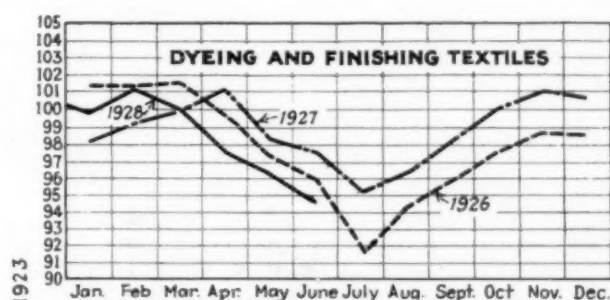
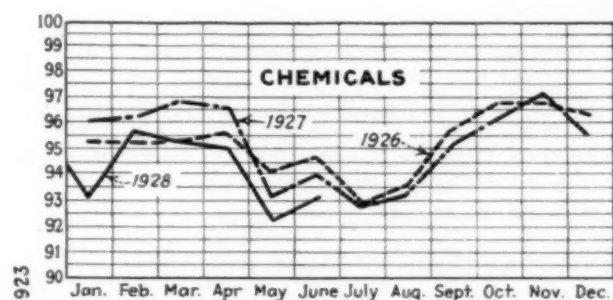
		January	February	March	April	May	June	Total
Domestic Production								
Acetate of lime.....	1927.. lb.	14,180,664	12,667,411	14,223,334	13,138,663	12,552,019	12,070,249	78,824,340
	1928.. lb.	12,519,188	11,717,836	13,022,129	11,693,048	10,786,859	9,125,727	69,064,787
Alcohol, ethyl.....	1927.. gal.	13,235,000	10,324,000	11,491,000	12,674,000	13,052,000	13,831,000	74,597,000
	1928.. gal.	13,050,000	11,220,000	11,050,000	11,784,000	11,043,000	.....	58,147,000*
Arsenic, crude.....	1927.. ton	1,414	1,147	1,380	1,075	905	1,003	6,924
	1928.. ton	1,158	1,600	1,076	1,098	1,225	.....	6,157*
Arsenic, refined.....	1927.. ton	913	810	1,030	925	1,432	1,155	5,265
	1928.. ton	827	2,005	1,834	1,863	1,876	.....	8,405*
Automobiles								
Passenger cars.....	1927.. no.	199,650	264,171	345,911	357,009	357,150	278,729	1,802,620
	1928.. no.	205,576	291,151	371,821	364,877	375,863	356,439	1,965,727
Trucks.....	1927.. no.	39,277	40,592	48,532	48,750	46,965	43,238	266,354
	1928.. no.	26,117	32,658	41,558	45,312	52,133	40,275	238,050
Cotton consumed in textile mills.....	1927.. bales	603,242	589,513	693,081	618,279	629,948	659,841	3,793,904
	1928.. bales	582,417	573,810	581,318	525,158	577,710	510,565	3,350,978
Fertilizer consumed in southern states.....	1927.. ton	526,771	836,610	1,498,537	870,224	146,454	.....	2,930,837
	1928.. ton	603,343	1,113,569	2,185,435	862,878	198,810	52,241	4,964,035*
Glass, plate.....	1927.. sq.ft.	8,484,000	9,790,000	11,641,000	10,299,000	9,618,000	7,999,000	57,831,000
	1928.. sq.ft.	8,205,000	10,093,000	11,297,000	9,953,000	10,224,000	10,723,000	60,495,000
Glass containers.....	1927.. gross	2,032,000	1,942,000	2,234,000	2,205,000	2,197,000	2,277,000	12,887,000
	1928.. gross	2,207,000	2,085,000	2,570,000	2,421,000	2,688,000	2,589,000	14,560,000
Coke, byproduct.....	1927.. ton	3,700,000	3,435,000	3,880,000	3,708,000	3,788,000	3,597,000	22,108,000
	1928.. ton	3,897,000	2,233,000	4,065,000	3,925,000	4,084,000	3,961,000	22,165,000
Methanol, crude.....	1927.. gal.	805,473	680,583	726,694	666,638	638,376	626,789	4,144,553
	1928.. gal.	649,551	592,855	657,460	607,253	559,604	460,627	3,527,350
Petroleum refining run to stills.....	1927.. bbl.	69,603,000	63,036,000	68,741,000	66,624,000	69,759,000	68,022,000	405,785,000
	1928.. bbl.	68,193,000	65,601,000	72,124,000	72,979,000	77,311,000	68,657,000	424,865,000
Pneumatic tires.....	1927.. no.	3,731,000	3,834,000	4,727,000	4,732,000	4,629,000	4,678,000	26,341,000*
	1928.. no.	4,026,000	4,784,000	5,128,000	4,645,000	5,082,000	.....	23,665,000*
Turpentine, wood.....	1927.. bbl.	7,053	6,587	7,253	7,035	6,974	6,541	41,453
	1928.. bbl.	5,771	5,645	6,647	6,062	6,350	5,700	36,175
Pine oil.....	1927.. gal.	241,563	207,197	245,232	239,027	243,880	222,151	1,399,050
	1928.. gal.	198,646	237,953	259,079	240,845	248,606	191,947	1,377,076
Wood pulp, chemical.....	1927.. ton	229,580	206,646	235,408	218,996	214,848	214,816	1,302,294
	1928.. ton	209,106	209,820	228,692	210,780	222,924	.....	1,081,322*
Wool consumed by textile mills, grease equivalent	1927.. lb.	46,389,000	45,938,000	54,262,000	43,971,000	44,338,000	45,006,000	279,904,000
	1928.. lb.	45,087,000	48,324,000	46,757,000	38,855,000	43,911,000	41,282,000	64,216,000

* Total for 5 months ended May.

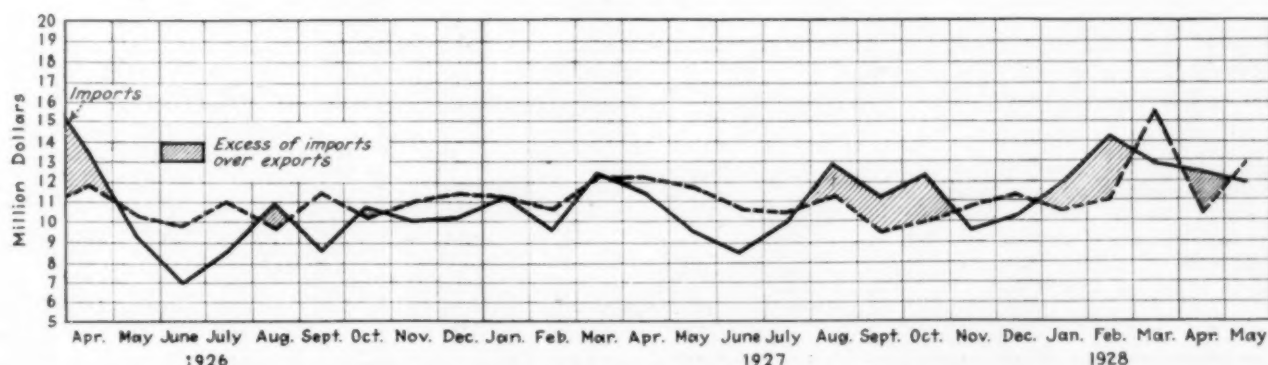
INDEXES OF ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



VOLUME OF PRODUCTION (U. S. Dept. of Commerce)



FACTORY EMPLOYMENT (U. S. Dept. of Labor)



FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS

MARKET CONDITIONS *and* PRICE TRENDS

Contract Deliveries of Chemicals Continued on Active Scale

Fairly Steady Movement To Consumers
Has Featured Warm Weather Period

WHILE SPOT trading in chemicals has slowed up during the summer months, withdrawals against contract commitments have pursued a fairly steady course. The paper trade has curtailed its requirements for liquid chlorine and bleaching powder and closing of glass plants had the effect of lessening shipments of soda ash. In general, however, heavy chemicals have been moved in large volume from producing points and consuming industries have operated on a larger scale than had been anticipated.

Reports from sulphur producers have indicated considerable increase in the output of that material and while large amounts have been shipped to foreign countries, it is evident that domestic consumers have increased their demands over that of last year and this is reported as especially true of sulphuric acid makers.

Chlorate of potash attracted attention during the interval because a sharp downward revision in the openly quoted price. The market has been under pressure for some time as representatives of importers were underselling the quoted levels. The decline in quotations, therefore, merely placed the open price more in line with the actual sales price. The importance of the price movement is more apparent in view of reports that current prices are too low to permit domestic manufacturers to operate at a profit.

PRODUCERS of calcium arsenate have failed to find any active call for their product. The carryover of stocks from last season was relatively light, but buying interest has not been such as to encourage production. This condition has been reflected in the market for white arsenic and use of the latter in the insecticide trade has been of a disappointing nature. On the other hand, agricultural demand for copper sulphate has been unusually heavy and producers had difficulty last month in making shipments as promptly as consumers demanded. Weather conditions are reported to have favored large consumption of copper sulphate, but it appears that world consumption of this chemical is gaining, as Italy, which is the largest producing country, has steadily increased its output and, in addition to taking care of a large home consumption, it exported 10,826 metric tons in 1927. Active demand also has been reported for chlorate of soda as a weed killer and large amounts of copper car-

bonate have been shipped to wheat-producing states. Therefore, demand for agricultural chemicals, as a whole, has been satisfactory despite the slow movement of calcium arsenate.

ANOTHER development of interest during the month was found in the market for nitrate of soda. Different rumors were in circulation relative to plans of producers in Chile. It was stated that a sales plan was being worked to function along the lines pursued by the foreign potash combine. This was, no doubt, occasioned by advices from Chile which stated that control of marketing nitrate was contemplated by producers.

A cable from Commercial Attaché Ackerman at Santiago reports that centralized selling of nitrate will become effective as of September 1, in accordance with the plan proposed by the directors of the Chilean Nitrate Producers' Association.

It is understood that this plan meets with government approval and that it will be accepted at the general meeting of the members of the association which was scheduled to be held on August 8.

Developments during the month in the market for alcohol have been of interest. In the first place, it was announced that production of industrial alcohol for 1929 would be fixed at 85,000,000 proof gallons which coincides with the allowable output for this year. The amount specified will be subject to modification if requirements of industry increase in the next few months. The Industrial Alcohol Institute, whose members produce 97 per cent of the industrial alcohol supply, reports stock on hand June 30, of 9,438,496 wine gallons or 48 per cent less than in June, 1927.

With surplus stocks reduced and production on a curtailed basis—the June output was 11½ per cent under that for

June, 1927—prices for alcohol are on a firm basis. In accordance with the schedule an automatic increase in price became effective on August 1 and a further increase will apply on September-December deliveries. While the closer relationship between production and consumption has had a strengthening effect on values, the firmness is accentuated by the probability that contract prices for blackstrap molasses will be higher for 1929 deliveries. In fact some producers of alcohol are reported to have placed contracts for molasses at the higher levels and some reports state that production costs for alcohol next year will be at least 6c. per gal. higher than they were this year.

OFFERINGS of permanganate of potash for shipment from Europe have been stronger in recent weeks and spot holdings of the imported material have commanded higher prices. This has had a strengthening effect on the domestic product and delivered prices have been on a higher basis.

The position of glycerine has failed to improve and preponderance of supply over demand has kept surplus holdings relatively high with a depressing effect on values. Reports from European markets indicate that the buying movement abroad has not widened but the situation has improved because of a material lessening of production. If this curtailment in output abroad continues and buying for anti-freeze account becomes active, the domestic market may change for the better in the near future.

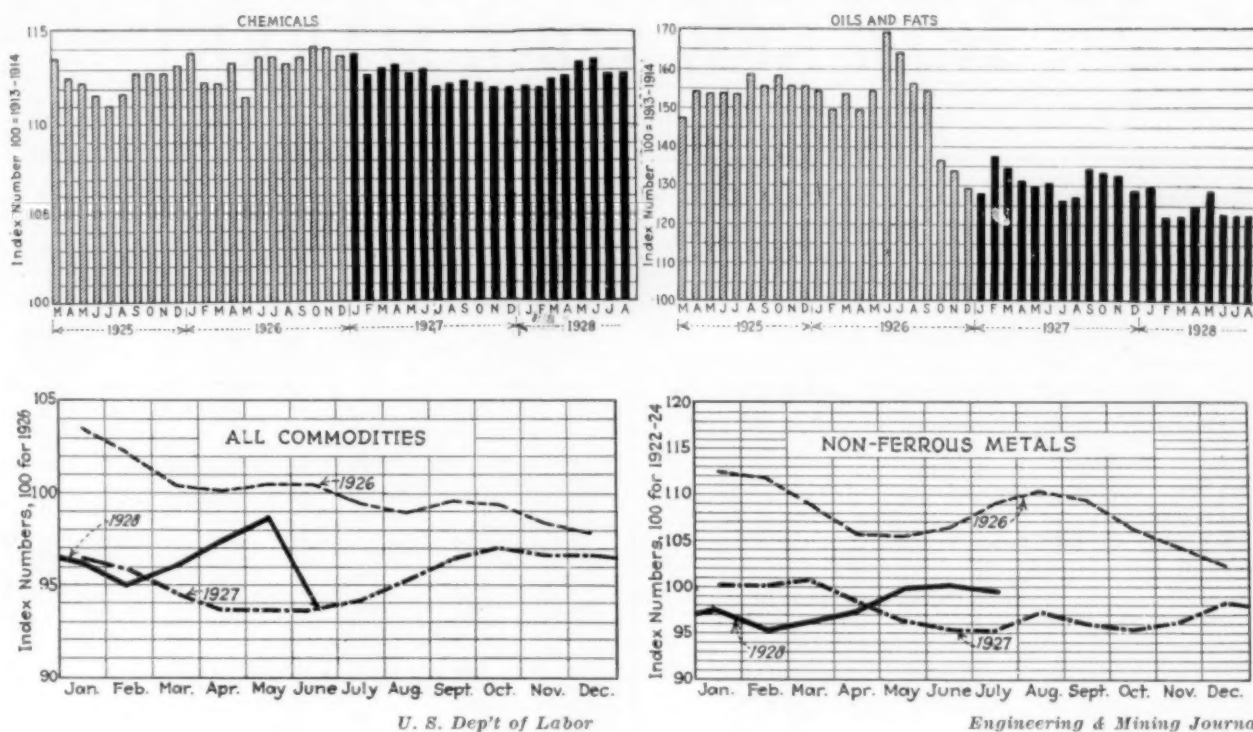
Coal-tar chemicals are holding a steady course with unfrequent changes in quotations. Imports of cresylic acid have not been large enough to create any surplus in spot holdings. Naphthalene likewise has been well sold ahead and prompt deliveries have commanded a premium. Toluol production is largely taken up by contract commitments and the market is in a strong position.

The government crop report issued last week gave condition of flaxseed as of Aug. 1 at 83.3 as against 76.8 a month ago. Indicated yield was 24,500,000 bu. compared with 21,500,000 bu. in the report for July.

Stocks of Turpentine and Rosin, as of March 31

	Turpentine, Gal.			Rosin, 500-Lb. Bbl.		
	1928	1927	1926	1928	1927	1926
Gum turpentine stills.....		No data available	378,400		No data	92,243
Steam district plants.....	543,114	347,627	142,847	98,101	53,866	22,616
Dist. district plants.....		91,779	91,097			
Southern primary ports.....	2,588,030	1,585,683	1,576,550	172,391	125,556	148,271
Eastern district points.....	399,015	222,792	235,500	6,623	7,439	3,801
Central district points.....	739,078	369,403	685,059	11,905	5,577	11,132
Western district points.....	181,693	108,021	94,500	5,803	1,065	613
Plants of industrial concerns.....	1,367,883	1,058,412	848,890	211,903	147,442	165,543
			4,052,834			444,221

¹Statistics, being compiled by the Bureau of the Census, not yet available

CHEM. & MET. *Weighted Indexs of PRICES*

Wood Distillation Chemicals Move Upward in Price

AN OUTSTANDING feature in the market for chemicals in the last month has been the strong price tendency of the wood distillation group. Higher prices prevailed for acetate of lime, acetone, methanol, and formaldehyde. Reduced outputs are reported to have curtailed supplies and thus created a situation in which a marking up of values was logical. Synthetic methanol also was advanced in price but the domestic output will soon be increased and competitive selling may follow.

While demand for chemicals has been cut down during the hot weather period, there has not been any prominent price-cutting and surplus stocks apparently are not large. With the outlook favoring an active call for raw materials in

the third quarter of the year, prospects are more favorable for a stiffening in prices than for a decline.

Competition from foreign-made chemicals is a price factor in some cases. This was responsible for the sharp decline in the quotations for chlorate of potash during the last few weeks. Prices were irregular before the decline was announced and the present level is hardly conducive to any expansion in domestic production. Ultimate control of the market by the imported product probably will mean an upward revision of prices but the low level may continue long enough to permit large consumers to place contracts to their advantage.

The following out of an upward schedule of sales prices for alcohol has demonstrated that producers are in command of the situation and proves the truth of reports that large surplus stocks have been taken from the market. Future values promise to be firm not only because of this control but also because producing costs will be higher next year because of the raw material situation. It is almost certain that quotations for alcohol for 1929 delivery will be higher than those which were effective this year.

Possible increases in import duty confront the market for tartaric acid and cream of tartar. Investigations have made considerable progress and the imposition of a 50 per cent increase

in the existing duty would unquestionably reduce competition and bring about higher prices.

FAVORABLE growing conditions in the cotton-producing states have had a bearish influence on values for vegetable oils. A large prospective supply of cottonseed has given greater significance to the large carryover of cottonseed oil and with current consuming demand for oil quiet, there has been a recession of values. Other vegetable oils are largely influenced by cottonseed oil and it is probable that the low level for prices has not yet been reached.

Linseed oil also is affected by crop prospects and has eased off during the period on reports that good progress has been made to date. It is too early to form any opinion regarding the coming harvest in the Argentine and the latter will be the factor which will determine the position of prices for oil over the coming year.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	112.83
Last month	112.80
August, 1927	112.35
August, 1926	113.33

Price changes were narrow with alcohol and wood distillation chemicals prominent on the strong side. Spot trading in other selections brought out price-shading but the weighted number showed a slight gain.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	120.61
Last month	122.63
August, 1927	126.97
August, 1926	156.50

The price trend in the market was downward with cottonseed oil under selling pressure. Olive oil foots, palm oil, and china wood oil commanded higher prices but other oils and fats were lower.

CURRENT PRICES in the NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to August 13.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums.....lb.	\$0.14-\$0.15	\$0.13-\$0.14	\$0.12-\$0.13
Acid, acetic, 28%, bbl.....cwt.	3.62-3.87	3.38-3.63	3.38-3.63
Boric, bbl.....lb.	.06- .07	.06- .07	.08- .08
Citric, kegs.....lb.	.46- .47	.46- .47	.44- .45
Formic, bbl.....lb.	.11- .12	.11- .12	.11- .12
Gallie, tech., bbl.....lb.	.50- .55	.50- .55	.50- .55
Hydrofluoric 30% carb., lb.	.06- .07	.06- .07	.06- .07
Lactic, 44%, tech., light, bbl lb.	.12- .12	.12- .12	.13- .14
22%, tech., light, bbl.....lb.	.05- .06	.05- .06	.06- .07
Muriatic, 18%, tanks.....cwt.	.85- .90	.85- .90	.85- .90
Nitric, 36%, carbonyl.....lb.	.05- .05	.05- .05	.05- .05
Oleum, tanks, wks.....ton	18.00-20.00	18.00-20.00	18.00-20.00
Oxalic, crystals, bbl.....lb.	.11- .11	.11- .11	.11- .11
Phosphoric, tech., c'ys.....lb.	.08- .09	.08- .09	.08- .09
Sulphuric, 60%, tanks.....ton	11.00-11.50	11.00-11.50	10.50-11.00
Tannic, tech., bbl.....lb.	.35- .40	.35- .40	.35- .40
Tartaric, powd., bbl.....lb.	.38- .38	.38- .38	.37- .37
Tungstic, bbl.....lb.	1.00- 1.20	1.00- 1.20	1.00- 1.20
Alcohol, ethyl, 190 p'f., bbl. gal.	2.68- 2.71	2.70- 2.75	3.75- 4.00
Alcohol, butyl, dr.....lb.	.18- .19	.18- .19	.19- .20
Denatured, 190 proof			
No. 1 special dr.....gal.	.45- .45	.44- .44	.47- .47
No. 5, 188 proof, dr.....gal.	.44- .44	.43- .43	.45- .45
Alum, ammonia, lump, bbl.....lb.	.03- .04	.03- .04	.03- .04
Chromic, bbl.....lb.	.05- .05	.05- .05	.05- .05
Potash, lump, bbl.....lb.	.02- .03	.02- .03	.02- .03
Aluminum sulphate, com., bags.....cwt.	1.40- 1.45	1.40- 1.45	1.40- 1.45
Iron free, bag.....cwt.	2.00- 2.10	2.00- 2.10	2.00- 2.10
Aqua ammonia, 26%, drums, lb.	.03- .04	.03- .04	.02- .03
Ammonia, anhydrous, cyl.....lb.	.13- .13	.13- .13	.11- .13
Ammonium carbonate, powd., tech., casks.....lb.	.12- .13	.10- .14	.10- .14
Sulphate, wks.....cwt.	2.35- .25	2.35- .25	2.25- .22
Amylacetate tech., drums.....gal.	1.75- 2.00	1.75- 2.00	2.15- 2.20
Antimony Oxide, bbl.....lb.	.10- .10	.12- .12	.16- .16
Arsenic, white, powd., bbl.....lb.	.04- .04	.04- .04	.03- .04
Red, powd., kegs.....lb.	.09- .10	.09- .10	.08- .09
Barium carbonate, bbl.....ton	60.00-62.00	57.50-60.00	50.00-52.00
Chloride, bbl.....ton	57.00-58.00	57.00-58.00	58.00-60.00
Nitrate, cask.....lb.	.07- .08	.07- .08	.08- .08
Blanc fixe, dry, bbl.....lb.	.03- .04	.03- .04	.04- .04
Bleaching powder, f.o.b., wks., drums.....cwt.	2.00- 2.10	2.00- 2.10	2.00- 2.10
Borax, bbl.....lb.	.02- .03	.02- .03	.04- .04
Bromine, ca.....lb.	.45- .47	.45- .47	.45- .47
Calcium acetate, bags.....cwt.	4.00- .06	3.50- .07	3.50- .08
Arsenate, dr.....lb.	.06- .07	.06- .07	.07- .08
Carbide drums.....lb.	.05- .06	.05- .06	.05- .06
Chloride, fused, dr., wks.....ton	20.00- .07	20.00- .07	21.00- .07
Phosphate, bbl.....lb.	.07- .07	.05- .06	.05- .06
Carbon bisulphide, drums.....lb.	.05- .06	.05- .06	.06- .07
Tetrachloride drums.....lb.	.06- .07	.06- .07	.06- .07
Chlorine, liquid, tanks, wks.....lb.	.03- .04	.03- .04	.04- .04
Cylinders.....lb.	.05- .08	.05- .08	.05- .08
Cobalt oxide, cans.....lb.	2.10- 2.20	2.10- 2.20	2.10- 2.25
Copperas, bags, f.o.b. wks.....ton	16.00-17.00	16.00-17.00	14.00-17.00
Copper carbonate, bbl.....lb.	.17- .17	.16- .17	.17- .18
Cyanide, tech., bbl.....lb.	.49- .50	.49- .50	.49- .50
Sulphate, bbl.....cwt.	5.30- 5.50	5.30- 5.50	4.90- 5.00
Cream of tartar, bbl.....lb.	.26- .27	.26- .27	.26- .27
Diethylene glycol, dr.....lb.	.10- .15	.10- .15	.10- .15
Epsom salt, dom., tech., bbl, cwt.	1.75- 2.15	1.75- 2.00	1.75- 2.00
Imp., tech., bags.....cwt.	1.15- 1.25	1.15- 1.25	1.35- 1.40
Ethyl acetate, drums.....gal.	.82- .84	.82- .84	.74- .76
Formaldehyde, 40%, bbl.....lb.	.08- .08	.07- .08	.11- .11
Furfural, dr.....lb.	.15- .17	.15- .17	.15- .17
Fusel oil, crude, drums.....gal.	1.30- 1.40	1.30- 1.40	1.40- 1.50
Refined, dr.....gal.	2.50- 3.00	2.50- 3.00	2.50- 3.00
Glauber's salt, bags.....cwt.	1.10- 1.20	1.10- 1.20	1.00- 1.10
Glycerine, e.p., drums, extra, lb.	.14- .15	.15- .15	.23- .24
Lead:			
White, basic carbonate, dry, casks.....lb.	.08- .08	.08- .08	.09- .09
White, basic sulphate, sek, lb.	.07- .07	.07- .07	.08- .08
Red, dry, sek.....lb.	.09- .09	.09- .09	.10- .10
Lead acetate, white crys., bbl, lb.	.13- .13	.13- .13	.13- .13
Lead arsenate, powd., bbl.....lb.	.13- .14	.13- .14	.12- .13
Lime, chem., bulk.....ton	8.50- .08	8.50- .08	8.50- .09
Litharge, powd., cask.....lb.	.05- .06	.05- .06	.05- .06
Magnesium carb., tech., bags, lb.	.06- .07	.06- .07	.07- .08
Methanol, 95%, dr.....gal.	.55- .55	.48- .48	.55- .55
97%, dr.....gal.	.55- .55	.48- .48	.55- .55
Nickel salt, double, bbl.....lb.	.10- .10	.10- .10	.10- .10
Single, bbl.....lb.	.10- .11	.10- .11	.10- .11

	Current Price	Last Month	Last Year
Orange mineral, cask.....lb.	\$0.11- .62	\$0.11- .62	\$0.12- .65
Phosphorus, red, cases.....lb.	.62- .65	.62- .65	.62- .65
Yellow, cases.....lb.	.32- .33	.32- .34	.32- .33
Potassium bichromate, casks, lb.	.08- .08	.08- .08	.08- .08
Carbonate, 80-85%, calc., cask, lb.	.05- .06	.05- .06	.05- .06
Chlorate, powd.....lb.	.06- .07	.08- .08	.08- .09
Cyanide, ca.....lb.	.52- .55	.51- .53	.55- .57
First sorts, cask.....lb.	.08- .09	.08- .09	.08- .09
Hydroxide (caustic potash) dr, lb.	.07- .07	.07- .07	.07- .07
Muriate, 80% bags.....ton	36.40- .06	36.40- .06	36.40- .07
Nitrate, bbl.....lb.	.06- .06	.06- .06	.06- .07
Permanganate, drums.....lb.	.15- .16	.15- .16	.14- .15
Prussiate, yellow, casks.....lb.	.17- .19	.17- .19	.18- .19
Sal ammoniac, white, casks, lb.	.04- .05	.04- .05	.05- .06
Salsoda, bbl.....cwt.	.90- .95	.90- .95	.90- .95
Salt cake, bulk.....ton	14.00-17.00	14.00-17.00	17.00-19.00
Soda ash, light, 58%, bags, contract.....cwt.	1.32- .35	1.32- .35	1.32- .37
Dense, bags.....cwt.	1.35- .35	1.35- .35	1.37- .37
Soda, caustic, 76%, solid, drums, contract.....cwt.	2.80- 3.00	2.80- 3.00	3.00- 3.10
Acetate, works, bbl.....lb.	.05- .06	.05- .06	.04- .05
Bicarbonate, bbl.....cwt.	2.00- 2.25	2.00- 2.25	2.00- 2.25
Bichromate, casks.....lb.	.07- .07	.07- .07	.06- .06
Bisulphate, bulk.....ton	3.00- 3.50	3.00- 3.50	5.00- 5.50
Bisulphite, bbl.....lb.	.03- .03	.03- .03	.03- .04
Chlorate, kegs.....lb.	.05- .06	.05- .06	.06- .06
Chloride, tech.....ton	12.00-14.75	12.00-14.75	12.00-14.00
Cyanide, cases, dom.....lb.	.18- .22	.18- .22	.18- .22
Fluoride, bbl.....lb.	.08- .09	.08- .09	.08- .09
Hyposulphite, bbl.....lb.	2.50- 3.00	2.50- 3.00	2.50- 3.00
Nitrate, bags.....cwt.	2.15- .22	2.22- .22	2.50- .25
Nitrite, casks.....lb.	.07- .08	.07- .08	.08- .08
Phosphate, dibasic, bbl.....lb.	.03- .03	.03- .03	.03- .03
Prussiate, dry, drums.....lb.	.11- .12	.11- .12	.12- .12
Silicate (30%, drums).....cwt.	.75- 1.15	.75- 1.15	.75- 1.15
Sulphide, fused, 60-62%, dr, lb.	.02- .03	.02- .03	.03- .04
Sulphite, crys., bbl.....lb.	.02- .03	.02- .03	.02- .03
Strontium nitrate, bbl.....lb.	.09- .09	.09- .09	.08- .09
Sulphur, crude at mine, bulk, ton	18.00- .04	18.00- .04	18.00- .05
Chloride, dr.....lb.	.04- .05	.04- .05	.05- .05
Dioxide, cyl.....lb.	.09- .10	.09- .10	.09- .10
Flour, bag.....cwt.	2.70- 3.00	2.70- 3.00	2.70- 3.00
Tin bichloride, bbl.....lb.	.14- .14	.14- .14	.18- .18
Oxide, bbl.....lb.	.53- .53	.53- .53	.67- .67
Crystals, bbl.....lb.	.36- .36	.36- .36	.45- .45
Zinc chloride, gran., bbl.....lb.	.06- .06	.06- .06	.06- .06
Carbonate, bbl.....lb.	.10- .11	.10- .10	.10- .11
Cyanide, dr.....lb.	.40- .41	.40- .41	.40- .41
Dust, bbl.....lb.	.08- .09	.08- .09	.09- .10
Zinc oxide, lead free, bag, lb.	.06- .06	.06- .06	.06- .06
5% lead sulphate, bags.....lb.	.06- .06	.06- .06	.06- .06
Sulphate, bbl.....cwt.	2.75- 3.00	2.75- 3.00	2.75- 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.....lb.	\$0.12- \$0.13	\$0.13- \$0.14	\$0.12- \$0.13
Chinawood oil, bbl.....lb.	.15- .15	.15- .15	.17- .17
Coconut oil, Ceylon, tanks, N. Y.....lb.	.08- .08	.08- .08	.08- .08
Corn oil crude, tanks, (f.o.b. mill).....lb.	.08- .08	.08- .08	.11- .11
Cottonseed oil, crude (f.o.b. mill), tanks.....lb.	.08- .08	.08- .08	.08- .08
Linseed oil, raw, ear lots, bbl, lb.	.09- .09	.10- .10	.08- .08
Palm, Lagos, casks.....lb.	.08- .07	.07- .07	.07- .07
Niger, casks.....lb.	.07- .07	.07- .07	.07- .07
Palm Kernel, bbl.....lb.	.09- .09	.09- .09	.08- .08
Peanut oil, crude, tanks (mill) lb.	.08- .09	.09- .09	.12- .12
Rapeseed oil, refined, bbl, gal.	.90- .92	.90- .92	.78- .80
Sesame, bbl.....lb.	.90- .92	.90- .92	.78- .80
Soya bean tank (f.o.b. Coast) lb.	.09- .09	.09- .09	.09- .09
Sulphur (olive foots), bbl.....lb.	.10- .10	.09- .09	.08- .08
Cod, Newfoundland, bbl.....gal.	.68- .69	.68- .69	.63- .65
Menhaden, light pressed, bbl, gal.	.62- .64	.62- .64	.60- .62
Crude, tanks (f.o.b. factory) gal.	.42- .45	.45- .45	.41- .41
Whale, crude, tanks.....lb.	.73- .73	.73- .73	.73- .73
Grease, yellow, loose.....lb.	.07- .07	.07- .07	.06- .06
Oleo stearine.....lb.	.10- .10	.09- .09	.09- .09
Red oil, distilled, d.p. bbl.....lb.	.09- .09	.09- .09	.09- .09
Tallow, extra, loose.....lb.	.08- .08	.08- .08	.07- .07

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.....lb.	\$0.60- \$0.65	\$0.60- \$0.65	\$0.60- \$0.62
Refined, bbl.....lb.	.85- .90	.85- .90	.85- .90
Alpha-naphthylamine, bbl.....lb.	.35- .36	.35- .36	.35- .36
Aniline oil, drums, extra.....lb.	.15- .16	.15- .16	.15- .16
Aniline salts, bbl.....lb.	.24- .25	.24- .25	.24- .25
Anthracene, 80%, drums.....lb.	.60- .65	.60- .65	.60- .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr. lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl. lb.	.70 - .72	.70 - .75	.70 - .72
Benzic acid, U.S.P., kgs. lb.	.58 - .60	.58 - .60	.58 - .60
Benzyl chloride, tech, dr. lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works. . . . gal.	.22 - .23	.22 - .23	.24 - .25
Beta-naphthol, tech., drums. lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr. lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks. gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr. lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl. lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl. lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr. gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl. lb.	.45 - .47	.45 - .47	.45 - .47
H-acid, bbl. lb.	.63 - .65	.63 - .65	.63 - .65
Naphthalene, flake, bbl. lb.	.05 - .06	.05 - .06	.04 - .05
Nitrobenzene, dr. lb.	.08 - .10	.08 - .10	.09 - .10
Para-nitraniline, bbl. lb.	.52 - .53	.52 - .53	.52 - .53
Para-nitrotoluene, bbl. lb.	.28 - .32	.28 - .32	.28 - .32
Phenol, U.S.P., drums. lb.	.15 - .17	.15 - .17	.17 - .18
Picric acid, bbl. lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr. lb.	1.35 - 1.50	1.35 - 1.50	3.00 -
R-salt, bbl. lb.	.47 - .50	.47 - .50	.47 - .50
Resorcinol, tech, kgs. lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl. . . . lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks. gal.	.35 - . . . .	.35 - . . . .	.35 -
Tolidine, bbl. lb.	.95 - .95	.95 - .96	.95 - .96
Toluene, tanks, works. gal.	.35 - . . . .	.35 - . . . .	.35 -
Xylene, com., tanks. gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl. ton	\$23.00-\$25.00	\$23.00-\$25.00	\$23.00-\$25.00
Casein, tech., bbl. lb.	.16 - .17	.15 - .16	.17 - .18
China clay, dom., f.o.b. mine ton	10.00 - 20.00	10.00 - 20.00	10.00 - 20.00
Dry colors:			
Carbon gas, black (wks.) . . . lb.	.07 - .08	.06 - .07	.06 - .07
Prussian blue, bbl. lb.	.31 - .33	.31 - .33	.33 - .34
Ultramarine blue, bbl. lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl. lb.	.27 - .31	.27 - .30	.27 - .30
Carmine red, tins. lb.	5.25 - 5.50	5.25 - 5.50	5.50 - 5.75
Para toner. lb.	.60 - .70	.60 - .70	.80 - .90
Vermilion, English, bbl. . . . lb.	1.80 - 1.85	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl. lb.	.15 - .16	.15 - .16	.17 - .18
Feldspar, No. 1 (f.o.b. N. C.) ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl. lb.	.08 - .08	.08 - .08	.08 - .09
Gum opal, Congo, bags. . . . lb.	.07 - .08	.07 - .08	.09 - .10
Manila, bags. lb.	.15 - .18	.15 - .16	.15 - .18
Damar, Batavia, cases. . . . lb.	.22 - .23	.22 - .23	.25 - .25
Kauri, No. 1 cases. lb.	.48 - .53	.48 - .53	.55 - .57
Kieselguhr (f.o.b. N. Y.) . . . ton	50.00 - 55.00	50.00 - 55.00	50.00 - 55.00
Magnesite, calc. ton	40.00 -	40.00 -	44.00 -
Pumice stone, lump, bbl. . . . lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks. lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H. bbl.	9.85 -	9.85 -	10.90 -
Turpentine. gal.	.53 - . . . .	.53 - . . . .	.61 -
Shellac, orange, fine, bags. . lb.	.61 - . . . .	.52 - . . . .	.52 - .53
Bleached, bonedry, bags. . . lb.	.60 - .56	.54 - .56	.59 - .61
T. N. bags. lb.	.47 - .48	.45 - .46	.40 - .45
Soapstone (f.o.b. Vt.), bags. ton	10.00 - 12.00	10.00 - 12.00	10.00 - 12.00
Talc, 200 mesh (f.o.b. Vt.) . . ton	9.50 -	9.50 -	10.50 -
300 mesh (f.o.b. Ga.) . . . ton	7.50 - 10.00	7.50 - 10.00	7.50 - 11.00
225 mesh (f.o.b. N. Y.) . . . ton	13.75 -	13.75 -	13.75 -

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl. lb.	\$0.30 - \$0.32	\$0.30 - \$0.32	\$0.25 - \$0.26
Beeswax, ref., light. lb.	.41 - .42	.41 - .42	.45 - .46
Candelilla, bags. lb.	.23 - .24	.23 - .24	.33 - .34
Carnauba, No. 1, bags. . . . lb.	.50 - .51	.50 - .51	.65 - .70
Paraffine, crude 105-110 m.p. lb.	.04 - .05	.04 - .05	.05 - .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18% ton	\$200.00 -	\$200.00 -	\$200.00 -
Ferromanganese, 78-82% . . . ton	105.00 -	105.00 -	90.00 -
Spiegelisen, 19-21% ton	32.00 -	32.00 -	33.00 - 35.00
Ferrosilicon, 14-17% ton	45.00 -	45.00 - . . . .	. . . . .
Ferrotungsten, 70-80% lb.	.95 - .98	.95 - .98	.95 - .98
Ferro-uranium, 35-50% lb.	4.50 -	4.50 -	4.50 -
Ferrovanadium, 30-40% lb.	3.15 - 3.75	3.15 - 3.75	3.15 - 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic. lb.	\$0.14 -	\$0.14 -	\$0.13 -
Aluminum, 96-99% lb.	.24 - .26	.24 - .26	.26 - .28
Antimony, Chin. and Jap. . . lb.	.09 - . . . .	.10 - . . . .	.12 -
Nickel, 99% lb.	.33 - . . . .	.35 - . . . .	.35 -
Monel metal, blocks. lb.	.28 - . . . .	.28 - .28	.32 - .33
Tin, 5-ton lots, Straits. . . . lb.	.49 - . . . .	.46 - . . . .	.64 -
Lead, New York, spot. lb.	6.20 -	6.20 -	6.75 -
Zinc, New York, spot. lb.	6.60 -	6.55 -	6.70 -
Silver, commercial. oz.	.59 - . . . .	.57 - . . . .	.57 -
Cadmium lb.	.60 - . . . .	.60 - . . . .	.60 -
Bismuth, ton lots. lb.	1.85 - 2.10	1.85 - 2.00	2.20 - 2.25
Cobalt. lb.	2.50 -	2.50 -	2.50 -
Magnesium, ingots, 99% . . . lb.	.98 - . . . .	.98 - . . . .	.75 - .80
Platinum, ref. oz.	76.00 - 76.50	75.50 - 76.50	86.00 -
Palladium, ref. oz.	46.00 - 49.00	46.00 - 49.00	59.00 - 63.00
Mercury, flask. lb.	122.50 -	121.50 -	121.00 -
Tungsten powder. lb.	1.05 - 1.15	1.05 -	1.05 -

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks. ton	\$7.50 - \$8.00	\$7.50 - \$8.50	\$5.50 - \$8.75
Chrome ore, c.f. post. ton	22.00 - 24.00	22.00 - 24.00	22.00 - 23.00
Coke, fdry., f.o.b. oven. . . . ton	2.85 - 3.00	2.85 - 3.00	3.25 - 3.75
Fluorspar, gravel, f.o.b. Ill. . . ton	16.00 -	16.00 -	17.00 -
Ilmenite, 52% TiO ₂ , Va. . . . lb.	.00 - .00	.00 - .00	.00 -
Manganese ore, 50% Mn., c.f. Atlantic Ports. . . . unit	.36 - .38	.36 - .38	.36 - .38
Molybdenite, 85% MoS ₂ per lb. MoS ₂ , N. Y. lb.	.48 - .50	.48 - .50	.48 - .50
Monazite, 6% of ThO ₂ ton	130.00 -	130.00 -	120.00 -
Pyrites, Span. fines, c.f. . . . unit	.13 - . . . .	.13 - . . . .	.13 -
Rutile, 94-96% TiO ₂ lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO ₃ and over. . . . unit	10.50 - 10.75	10.50 - 10.75	11.25 - 11.50
Vanadium ore, per lb. V ₂ O ₅ . lb.	nom.	nom. . . . .	.25 - .28
Zircon, 99% lb.	.03 - . . . .	.03 - . . . .	.03 -

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Aluminum Factory—U. S. Aluminum Co., c/o R. C. Wilson, 2210 Harvard Ave., Cleveland, O., had plans prepared for a 5 story, 68 x 138 ft. warehouse and pattern shop for aluminum factory. Estimated cost \$150,000. Private plans.

Ammonia Oxidation Plant—Hercules Powder Co., Carthage, Mo., awarded contract for the construction of an ammonia oxidation plant to Chemical Construction Co., 50 East 42nd St., New York, N. Y. Estimated cost \$300,000.

Beet Sugar Refinery—Superior Sugars, Ltd., Petrolia, Ont., plans to take over premises and equip a plant with capacity 800 tons of beets per day. F. O. Potter c/o owner, will purchase all the equipment. Estimated cost \$1,000,000.

Bottling Plant—Coco-Cola Bottling Co., 2540 Penn. Ave., Kansas City, Mo., having plans prepared for construction of an addition to bottling plant. Estimated cost \$100,000. H. Von Unwerth, Finance Bldg., Kansas City, Mo., is architect.

Brake Lining Plant—Raybestos Co., Railroad Ave., Bridgeport, Conn., S. Simpson, Pres., awarded contract for construction of a brake lining plant at Stratford, Conn., to W. J. Shaughnessy, Jr., Inc., Fairfield Ave., Bridgeport. Estimated cost to exceed \$40,000.

Brass Foundry—Federal Foundry Co., 52 South Harris St., Indianapolis, Ind., awarded contract for a group of buildings

including brass foundry to J. & F. Shafer Co., Smythe Bldg., Cleveland, O.

Brass and Copper Factory—Dallas Brass and Copper Co., 6601 W. Grand Ave., Chicago, Ill., awarded contract for factory to Moraw Constr. Co., 6449 South Park Ave. Estimated cost \$20,000.

Canning Factory—California Sanitary Canning Factory, 1583 Industrial St., Los Angeles, Calif., awarded contract for construction of canning factory, 100,000 sq. ft., at Long Beach Ave., to W. P. Neil Co., Inc., 4818 Loma Vista Ave., Los Angeles.

Chemistry Building—Dept. of Interior, U. S. Government, Washington, D. C., having plans prepared for chemistry building—Howard University. Estimated cost \$250,000. A. I. Cassell, c/o Howard University, is architect.

Chemistry Building—New Hampshire State College, Durham, N. H., awarded contract for a 4 story, 60 x 155 ft. chemistry building to S. Belanger & Son, Inc., 308 Main St., Nashua, N. H. Estimated cost \$225,000.

Chemistry and Physics Laboratories—Dept. of Education, Provincial Bldg., Regina, Ont., awarded contract for construction of Normal school including complete chemistry and physics laboratories at Moosejaw, Sask. Estimated cost \$350,000. Complete equipment for laboratories will be required.

Chlorine Machine—City of Heavener,

Okla., is in the market for a liquid chlorine machine for waterworks.

Chocolate Factory—Reichardt Cocoa & Chocolate Co., 50 Broad St., New York, N. Y., awarded contract for the construction of a 3 story, 60 x 200 ft. chocolate factory to Industrial Engineering Co., 50 Church St., New York, N. Y. Estimated cost \$200,000.

Compress Plant—Texas Compress Co., Ballinger, Tex., plans the construction of a compress plant near San Angelo, Tex. Estimated cost \$65,000. Machinery and equipment will be required. Work will probably be done by day labor.

Confectionery Factory—W. J. Carling, 24 West 78th St., New York, N. Y., plans the construction of a 3 story, 25 x 80 ft. confectionery factory at 236 West 78th St. Estimated cost \$40,000. G. F. Mitchell, 959 Madison Ave., New York, N. Y., is architect.

Drug Factory—Park Davis & Co., 2951 Atwater St., Detroit, Mich., will soon award contract for the construction of a 225 x 239 ft. drug factory at Jos. Campau St., Detroit, Mich. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., is architect.

Enamel Factory Addition—Ferro Enameling Co., C. M. Horn, Secy., B. F. Keith Bldg., Cleveland, O., awarded contract for a 2 story, 54 x 66 ft. addition to enamel factory to Philip Kirschner Co., 2725 Pittsburgh Ave., Cleveland, O. Estimated cost \$40,000.

Fertilizer Plant—Wilson and Toomer Fertilizer Co., Jacksonville, Fla., plans construction of a 260 x 520 ft. additional unit to fertilizer plant. Estimated cost \$75,000.

Gas Plant, Etc.—J. H. Hawthorne, Jr., Jonesboro, Ark., is having preliminary plans prepared for the construction of an artificial gas plant and approximately 20 miles of distribution mains at Blytheville, Ark. Private plans.

Gas Plant—Lexington-Thomasville Gas Co., N. H. Gilbert, Pres., Lexington N. C., awarded contract for the construction of an artificial gas plant, etc. to Atlantic Construction & Engineering Co., Philadelphia, Pa. Estimated cost \$175,000.

Glass Plant—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., will build a 4 story, 50 x 400 ft. addition to cutting room for glass plant at Clarksburg, W. Va. Estimated cost \$150,000. Work will be done by separate contracts. Also having preliminary plans prepared for construction of a glass factory at Okmulgee, Okla. Estimated cost \$35,000.

Gypsum Plant—U. S. Gypsum Co., Penobscot Bldg., Detroit, Mich., is having plans prepared for the construction of a gypsum factory at Davison St. and River Rouge. Equipment for handling raw gypsum and for manufacture of gypsum products will be required.

Gypsum Factory—U. S. Gypsum Co., 300 West Adams St., Chicago, Ill., awarded contract for construction of gypsum plant on Indiana Harbor Canal at East Chicago, Ind., to Turner Constr. Co., 228 LaSalle St., Chicago, Ill. Estimated cost \$2,500,000.

Helium Plant—Dept. Commerce, Bureau of Mins., Helium Division, Washington, D. C., awarded contracts for construction of buildings for helium plant at Amarillo, Tex., to J. T. Taylor, 707 1st Natl. Bank Bldg., Ft. Worth, Tex., gas and water tanks to Chicago Bridge & Iron Co., W. Van Buren St., Chicago, Ill., compressor to C. & G. Cooper Co., Mt. Vernon, O., well drilling to D. G. & W. D. Muncy, Amarillo, Tex. Estimated cost \$500,000.

Laboratory—T. D. Morris, Secy., South College, University of Tennessee, Knoxville, Tenn., will receive bids until Aug. 30, for construction of a laboratory building for Dept. of Chemistry. Barber and McMurry, General Bldg., Knoxville, Tenn., are architects.

Laboratory—University of Maryland, Lombard and Greene Sts., Baltimore, Md., will soon award contract for a 6 story, 166 x 195 ft. laboratory. Estimated cost \$400,000. Smith & May, Calvert Bldg., are architects.

Lacquer Factory—Egyptian Lacquer Mfg. Co., c/o John Davis & Co., 807 Second St., Agts., Seattle, Wash., plans the construction of a 2 story, 60 x 160 ft. factory at First St. and Lander Sts. Estimated cost \$150,000.

Lime Factory—W. D. Haden Co., 2315 Polk St., Houston, Tex., is having plans prepared for first unit of lime plant, 40 x 403 ft. at Goose Creek, Tex. Estimated cost \$350,000. Arnold & Weigel, Woodville, O., are architects.

Kilns—Homer Laughlin China Co., Newell, W. Va., awarded contract for two continuous kilns also 20 x 200 ft., building to Harrop Ceramic Service Co., 310 West Broad St., Columbia, O. Estimated cost \$150,000.

Milk Condensary—Page Milk Co., Merrill, Wis., awarded contract for the construction of a milk condensary at Marshall, Mo. to P. E. P. Page, Marshall, Mo. Estimated cost \$250,000.

Oil Refinery—Atlantic Refining Co., 260 South Broad St., Philadelphia, Pa., plans construction of an oil refinery at Atreco, on Neches River between Port Neches and Fort Arthur. New machinery and equipment will be required. Estimated cost \$500,000.

Oil Refinery—Moody Corp., subsidiary of Moody-Seagraves Co., Galveston, Tex., plans the construction of a 5,000 bbl. refinery at Big Springs, Tex. or on Gulf coast in Galveston-Houston Dist. Estimated cost \$150,000. Private plans.

Oil Refinery—Big Spring Pipe Line Co., c/o C. Groff, Douglas Hotel, Big Springs, Tex., will build an oil refinery near Big Springs, Tex. Estimated cost \$100,000. Machinery and equipment will be required.

Oil Refinery—Swift & Co., 916 East 1st St., Los Angeles, Calif., is taking bids for construction of a two and four story 114 x 212 ft. oil refinery at Vernon, Calif.

Paint Factory—Tower Products Co., 330 North Ashland Ave., Chicago, Ill., awarded contract for the construction of factory at 1500 Austin Ave., to G. Cook, Oak Manor Hotel, Oak Park.

Paper Mill—A. L. Adams Paper Co., Bauwauwau, Mass., awarded contract for construction of a paper mill to Fiske-Carter, 11 Foster St., Worcester, Mass. Estimated cost \$100,000.

Paper Mill—International Paper Co., Pershing Sq. Bldg., Park Ave. & 42nd St., New York City, plans construction of a paper mill, near Chickasaw Creek, Mobile, Ala. Estimated cost between \$4,000,000 and \$5,000,000. J. H. Allen, Cawthon Hotel, Mobile, Ala., is engineer.

Paper Mill—Leschner Paper Co., Harrison and State Sts., Cincinnati, O., awarded contract for the construction of a paper mill on State St. to Ferro Concrete Co., Elm St., Cincinnati, O. Estimated cost \$68,000.

Paper Mill—Zellerbach Paper Co., 1213 Front St., Sacramento, Calif., is having plans prepared for a 3 story, paper mill, etc. Estimated cost \$175,000. Architect not announced.

Paperboard Mill Addition—Chesapeake Paperboard Co., Key Highway and B. & O. R.R., soon lets contract for construction of an addition to paperboard mill. Estimated cost \$200,000. K. A. Lefreu, 171 Madison Ave., New York City, is engineer.

Paperboard Mill—Addition—Canadian Paperboard Co., Ft. Carlan Ave., Toronto, Ont., awarded contract for 70 x 320 ft. and 162 x 252 ft. addition to paperboard mill to W. J. Trimble, 73 Adelaide St., W. Toronto, Ont.

Paper Plant Addition, etc.—Tilston & Hollingsworth Paper Mfg. Co., 211 Congress St., Boston, awarded contract for addition to paper plant and warehouse on River St., Hyde Park (Br. Boston) Mass. to M. C. Tuttle Co., Park Eq. Bldg., Boston, Mass. Estimated cost \$100,000.

Pulp and Paper Mill—Pacific Coast Pulp & Paper Co., Los Angeles, Calif., C. A. Kieren, Clune Hotel, Sacramento, Calif., Mgr., is having plans prepared for a 1, 2 and 3 story pulp and paper mill including 32 x 75 ft. digester building, 60 x 240 ft. recovery plant, boiler plant, etc. at Richvale, Calif. Estimated cost \$1,000,000. P. Swan, Lewis Bldg., Portland, Ore., is engineer.

Radio Tube Factory—Sonotron Tube Co., 88 8th Ave., Newark, N. J., awarded contract for construction of a 4 story, 45 x 125 ft. radio tube factory to Drill Constr.

Co., 889 Broad St., Newark. Estimated cost \$60,000.

Rayon Mill—American Chatillon Corp., 393 7th Ave., New York City, awarded contract for the construction of a rayon mill at Rome, Ga., to Hughes Foulkrod Co., Shaft Bldg., Philadelphia, Pa. Estimated cost \$4,000,000. Lockwood-Greene, 1 Pershing Sq., New York City, will purchase equipment.

Rayon Plant—Industrial Rayon Co., Covington, Va., awarded contract for construction of buildings for rayon plant to Fiske-Carter Construction Co., Worcester, Mass. Estimated cost plant and machinery \$8,000,000.

Rubber Factory—Aetna Rubber Co., H. J. Kappler, V. Pres. and Gen. Mgr., 815 East 79th St., Cleveland, O., awarded contract for a 1 story, 60 x 180 ft. rubber factory, etc. at Ashtabula, O. to Webster Construction Co., Ashtabula, O. Estimated cost \$125,000.

Rubber Factory—Dryden Rubber Co., 1014 South Kildare Ave., Chicago, Ill., awarded contract for 2 story 27 x 120 ft. rubber factory to G. Kehl Sons, 1225 North Maplewood Ave., Chicago.

Rubber Factory—Ohio Rubber Co., Willoughby, O., awarded contract for construction of factory addition to Austin Co., 16112 Euclid Ave., Cleveland. Estimated cost \$50,000.

Storage Battery Factory—Willard Storage Battery Co., R. C. Norberg, V. Pres. and Gen. Mgr., 246 East 131st St., Cleveland, O., awarded contract for a 1 story, 64 x 212 ft. storage battery factory to S. W. Emerson Co., 1836 Euclid Ave., Cleveland, O. Estimated cost \$75,000.

Tile Factory—Olean Tile Co., Olean, N. Y., awarded contract for three factory buildings, 161 x 250, 96 x 105 and 50 x 362 ft., all 1 story to A. A. Lane Construction Co., 1869 East 55th St., Cleveland, O. Estimated cost \$300,000.

Smelter—International Nickel Co., 67 Wall St., New York City, has work under way on the construction of a new smelter, 3,000 tons daily capacity; also 4,500 ton concentrator at Sudbury, Ont. The plants are being built to take care of the coming into production of the Frood mine. Estimated cost between \$7,000,000 and \$9,000,000.

INDUSTRIAL NOTES

THE WAGNER ELECTRIC CORPORATION has appointed Fred Johnson to the Los Angeles branch office and A. L. Miltenberger to the St. Louis office.

COMBUSTION ENGINEERING CORPORATION has made W. O. Rankin manager of the industrial furnace department.

THE CHICAGO PNEUMATIC TOOL COMPANY has placed W. S. Lynch in charge of the Cincinnati office and A. M. Andresen in charge of the Seattle, Wash., office.

THE MACGREGOR VALVE COMPANY has added J. W. Cliff to its staff in the capacity of production manager.

THE SMITH-EMERY COMPANY, chemists and engineers, are now situated at 920 Santee St., Los Angeles, Calif.

THE NATIONAL METAL & RUBBER COMPANY, announces the removal of its offices to Oliver Building, 141 Milk Street, Boston, Mass.

THE NATIONAL FLUE CLEANER COMPANY, INC., has appointed the following new Southern representatives: Fuel Efficiency Engineering Company, Birmingham, Ala.; A. S. Furtwangler, Charleston, S. C.; Reed & Duecker, Memphis, Tenn.; Buckmaster-Luck-Malochie, New Orleans, La.; Henry Eggelhoff, Dallas, Texas.

LAYNE AND BOWLER, INC., have transferred W. H. Reeves to the Chicago office from the Layne-Southeastern Company, where R. R. Schweitzer is his successor.

THE ROBINSON MANUFACTURING COMPANY, Muncy, Pa., announces the acquisition of the Gedge-Gray Company, Lockland, Ohio, manufacturers of mixers and sifters.

THE ACHESON GRAPHITE CORPORATION, Niagara Falls, has become affiliated with the Union Carbide & Carbon Corporation through the acquisition of its common stock by the latter company. Besides an interchange of stock there will be no further changes involved.

THE ELLIOTT COMPANY, Jeannette, Pa.,

has organized an Elliott Company of California with headquarters at 813 Rialto Building, San Francisco. The officers are W. S. Elliott, president, F. A. Calmus, vice-president and general manager, and C. W. Moore, secretary-treasurer.

THE MONSANTO CHEMICAL WORKS have acquired additional property for the expansion of their fine chemical manufacture in St. Louis.

THE MARY ANN MINING COMPANY has sold its holdings to the Metals Exploration Company of Joplin, Mo.

THE AUSTIN MACHINERY CORPORATION, Muskegon, Mich., due to conditions tracing back to 1924, has made voluntary appointment of receivership and will continue its business otherwise as heretofore.

THE ROLLER-SMITH COMPANY, New York, has made E. E. Van Cleef district sales agent for Chicago at 53 W. Jackson Boulevard.

THE GAS CLEANING ENGINEERING CORPORATION, 320 Broadway, New York City, has been organized to design, engineer and contract for the construction of improved dry gas cleaning apparatus.

THE GENERAL ELECTRIC COMPANY is constructing a plant at Erie, Pa., for the production of porcelain enamel refrigerators.

THE DISSOWAY CHEMICAL COMPANY has closed its offices at 55 Eckford St., Brooklyn, and all further business will be carried on from the office of the J. T. Baker Chemical Company in the Graybar Building, New York City.

THE A. C. HORN COMPANY, Long Island City, N. Y., has appointed N. C. Chaney district manager for Ohio, Indiana, and Kentucky, with offices at 202 Ohio Bank Building, Cincinnati, Ohio.

THE CARRIER ENGINEERING CORPORATION has acquired and is refitting the former plant of the General Electric Company at 850 Frelinghuysen Avenue, Newark, N. J., for expansion of its activities.